Galaxy

MAGAZINE

SCIENCE FICTION

MARCH 1969 60¢

AND NOW THEY WAKE
by
KEITH LAUMER

✦

THE THEORY AND PRACTICE OF TELEPORTATION
by
LARRY NIVEN

✦

THE WEATHER ON WELLADAY
by
ANNE MC CAFFREY

✦

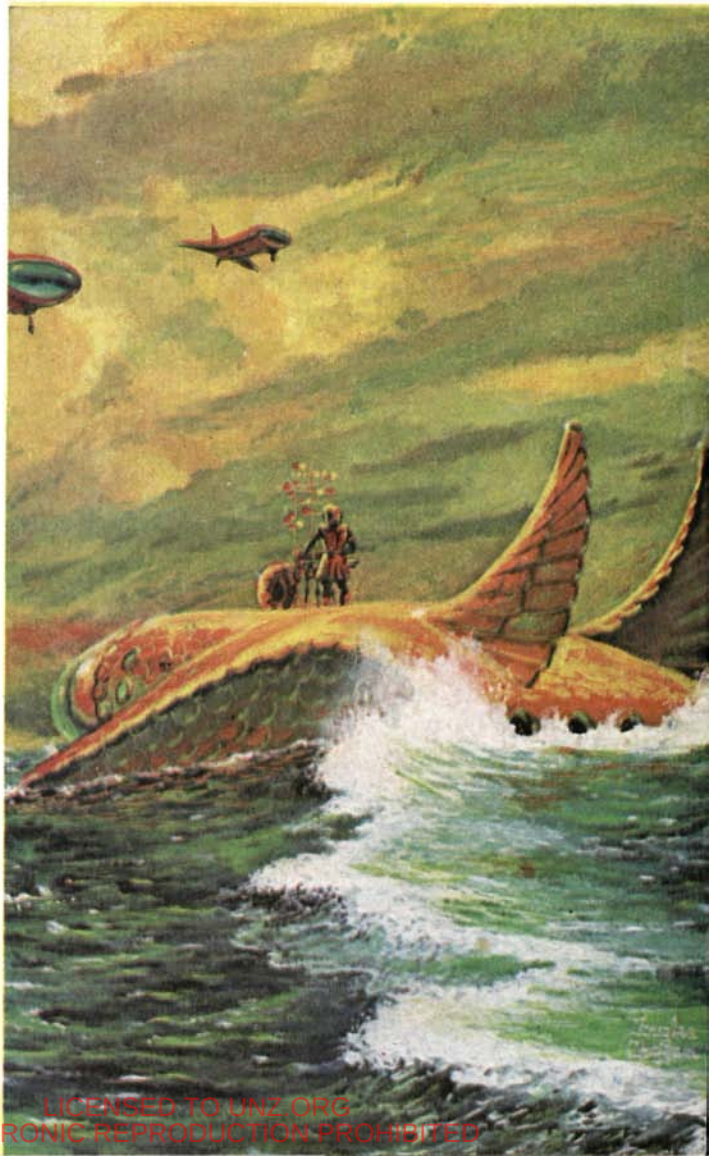
WILLY LEY

✦

ALGIS BUDRYS

✦

— and many more



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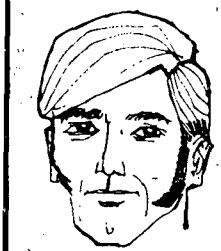

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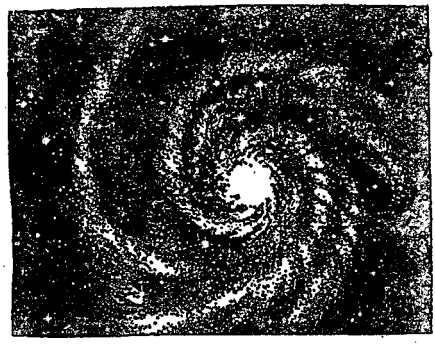
Galaxy MAGAZINE

ALL STORIES NEW

Galaxy is published in French, German, Italian, Japanese and Spanish. The U. S. Edition is published in Braille and Living Tape.



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The Election Everybody Won

We're pleased to announce the winners of the 1968 Galaxy Award (see the announcement elsewhere in this issue), and we particularly want to thank the hundreds of subscribers of *Galaxy* and *If* who did the voting.

You might be interested in the procedure. Our plan from the beginning was to have the choices made by the readers themselves, and to the maximum extent possible by all readers, rather than any particular group. Since we could not reach every reader of *If* and *Galaxy*, we limited the voting to subscribers, partly because their names were readily available to us, and partly because they would be in a good position to choose among all the eligible stories, since they would have in nearly all cases read them all. So we selected samples of subscribers at random (the number of persons chosen was relatively small — but by standard statistical criteria, enough for good reliability), and mailed them ballots.

One list of every story published in *If* in 1968 went to *If* subscribers; a similar list of *Galaxy* stories went to *Galaxy* subscribers. We asked them to indicate their favorites, totaled the votes and selected the top 10 from both magazines. A list of these 10 went to a further random sample of people who were subscribers to both *Galaxy* and *If*, and their votes picked the winners.

It was an interesting experience, and, we think, a worthwhile one. Certainly we now have an even better idea of what you like than we had before. We'll be doing it again next year! Meanwhile — to the winners, our congratulations to the voters, our thanks.

—THE EDITOR

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The Galaxy Awards

The editors of *Galaxy* and *If* are pleased to announce the winners of the 1968 Galaxy Awards for the best stories published in our magazines in the past year. The winning stories were chosen by polling randomly chosen groups of subscribers to both magazines, and their vote was final.

$1,000 Galaxy Award

Goblin Reservation
by Clifford D. Simak
(Serial, April and June issues of *Galaxy*.)

$250 Galaxy Award

Slowboat Cargo
by Larry Niven
(Serial, February, March and April issue of *If*.)

$100 Galaxy Award

(Due to the closeness of the voting, we are giving three $100 awards.)

The Man in the Maze, by Robert Silverberg
(Serial, April and May issues of *If*.)

Getting Through University, by Piers Anthony
(Novelette, August issue of If.)

The Time Trawlers, by Burt K. Filer
(Short story, August issue of *Galaxy*.)

Watch for announcement in an early issue of the 1969 Galaxy Awards.

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THANK YOU...

We're grateful to all the science-fiction fans who gave our publications a clean sweep of every professional Hugo Award at the 1967 World Science Fiction Convention. And we're proud that you've selected us for the Best Magazine Award for the past two consecutive years. We're even more grateful to the many loy readers who have made it possible for bot GALAXY and IF to appear monthly from no on. That means we can bring you twice a many of the best stories being written by th best science-fiction writers of all time.

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PART ONE OF THREE — SERIAL

AND NOW THEY WAKE

by KEITH LAUMER

Illustrated by GAUGHAN

For years beyond counting they had dragged out their miserable imprisonment on Earth — and now the day had come to live again!

PROLOGUE

Here in the darkness and the silence I dream of Ysar. In the mirror of my mind I see again her towers and minarets soaring in the eternal twilight of her yellow skies, casting long shadows across the lawn and pool and the tiled avenues where long ago victorious armies rode in processional under bright ban-

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ners. Amber light glows on flowering trees and the carved facades of jeweled palaces. Once more in memory I hear the music of horns heralding the approach of triumphant princes.

I recall the voices and faces of men and women, of warriors and queens, of tradesmen and viceroys, of metalworkers and courtesans, of those who have lived and walked these streets, rested beside these pools and fountains, under the ochre light of the forever setting sun of Ysar. And I see the scarred unconquerable ships, proud remnants of a once great fleet, true to their ancient pledge, mounting on columns of fire, setting course outward to face the enemy once again.

Here in the darkness and the silence, I wait, and dream of Ysar the well-beloved; and I vow that I will return to her, though it be at the end of time.

I

A man sat at a small desk beside an open window, writing with an old-fashioned steel nib pen which he dipped at intervals into a pot of blue-black ink. A soft sea-wind moved the curtain, bringing an odor of salt and kelp. Far away, a bell chimed out the hour of six P.M.

The man wrote a line, crossed it out, sat looking across the view of lawns and gardens. His face was strong-featured, square-jawed. His gray hair lay close to a finely formed skull. His fingers were thick, square-tipped; powerful fingers.

"Writing poems again, Mr. Grayle?" a voice spoke suddenly from the doorway behind the man. He turned with a faint smile.

"That's right, Ted." His voice was deep, soft, with a faint trace of accent.

"You like to write poems, don't you, Mr. Grayle?" Ted grinned in mild conspiracy.

"Um-hum."

"Hey, game time, Mr. Grayle. Guess you maybe didn't hear the bell."

"I guess not, Ted." Grayle rose.

"Boy oh boy, the Blues are going to mop up on the Reds tonight, hey, Mr. Grayle?" Ted stood aside as Grayle stepped out into the wide, well-lit corridor.

"Sure we will, Ted."

They walked along the passage, where other men were emerging from rooms.

"Well, tonight's the night, eh, Mr. Grayle?" Ted asked.

"Tonight?" Grayle inquired wildly.

"You know. The new power system goes on. Just pick it out of the air. Nifty, huh?"

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"I really didn't know that."

"You don't read the papers much, do you, Mr. Grayle."

"Not much, Ted."

"Boy oh boy." Ted waggled his head. "What will they come up with next?"

They crossed an airy court, passed through an arcade and emerged onto a wide, grassy meadow. Men dressed in simple well-made, one-piece garments, some bearing a red armband, others a blue, stood in groups talking, tossing a baseball back and forth.

"Go get 'em, Mr. Grayle," Ted said. "Show 'em the old stuff."

"That's right, Ted."

The man called Ted leaned against a column, arms folded, watched as Grayle walked across to join his team.

"Hey, that's the guy, hah?" a voice spoke beside Ted. He turned and gave an up-and-down frown to the young fellow who had come up beside him.

"What guy?"

"The mystery man. I been hearing about him. Nobody knows how long he's been here. I heard he killed a guy with an axe. He doesn't look so much to me."

"Mr. Grayle is an all-right guy, greenhorn," Ted said. "That's a lot of jetwash about nobody knows how long he's been here. They got records. They know, okay."

BB Ballantine Books

One of the peculiarities of writing news of current books for any magazine is the time difference. Thus in the depth of winter, hemmed in by sheet ice and under attack by the Asiatic hog cholera and a faulty stove, one finds oneself writing of books that will be available in the spring, a dream world months away. Still, there are compensations.

For instance, this spring comes more easily than most because of the joy of publishing Anne McCaffrey. An original novel, to boot. Original meaning never before published in any way, shape, or form. It's not often one can say that these days since most of this lady's work is published in magazine form just as rapidly as she can produce it.

Anyway, the book is titled DECISION AT DOONA, and it's 75c. Anyone who likes cats will love this one — anyone liking people will wonder. Aside from Miss McCaffrey, worshippers of E. R. Eddison (and you're either an enthusiast or you're damn well not) will be delighted by our original (here meaning "first American publication") of the MEZENTIAN GATE. In print, of course, we have THE WORM, FISH DINNER and MISTRESS OF MISTRESSES (all reprints of hardcover editions). THE GATE completes the group although not in chronological order. Each of the volumes is 95c

Thirdly we have our own reissue of what was originally our own original, Edmund Cooper's DEADLY IMAGE, as prophetic a novel as you're likely to find. First published in 1958. Now 75c.

There are other forms of originals — like a collection of short stories which have been done in magazines but never published together as a book, or expanded ver-

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sions of novelettes, or, or, or. There's no real need to be knowledgeable about publisher definitions of original but it's a point of interest to people over thirty who remember the days when everything was original. And 25c. No wonder everybody starved to death. The odd and happy thing is that now that prices have improved, many more (and better) books are being written and published than in the bad old days. Here's a partial listing

TITUS GROAN: Mervyn Peake .. 95c
GORMENGHAST: Mervyn Peake .. 95c
TITUS ALONE: Mervyn Peake .. 95c
MORE THAN HUMAN:
Theodore Sturgeon 75c
A VOYAGE TO ARCTURUS:
David Lindsay 95c
OMNIVORE: Piers Anthony 75c
PRIEST-KINGS OF GOR:
John Norman 75c
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And a complete reissue of all the Clarke books at 75c each.

We have hundreds more — send for our complete catalog, or order any of the above (with money) from Dept. GCS, Ballantine Books, 36 West 23rd Street, New York N.Y. 10003. Or write to us here at 101 Fifth Avenue, same city. Incidentally, as intelligent s.f. fans, you shouldn't miss the magnificent Sierra Club conservation books we're doing. Especially with that new boy they've got in the Department of the Interior. Support conservation any way you can, otherwise all we'll have left to look at will be our beautiful pictures. And while we like to make money as well as the next one, we'd rather breathe.

BB

"How long you been here, Ted?"

"Me? Five years, why?"

"I talked to Stengle; he's been here nineteen years. He says the guy was here then."

"So?"

"He looks old enough to be an old con."

"What's he supposed to look, old? So he's maybe thirty-five, maybe forty-five. So what?"

"I'm curious, is all."

"Hah," Ted said. "You college-trained guys. You got too many theories."

The young fellow shrugged. The two guards stood watching as the teams formed up for the nightly ball game played by the inmates of the Caine Island Federal Penitentiary.

It was a long, narrow room, dim, age-grimed, smelling of the spilled beers of generations. Weak late afternoon sunshine filtered through the bleary plate-glass window where garish blue glow letters spelled out FANGIO'S in reverse. A man with four chins and a bald skull bulked behind the bar, talking to a small, quick-eyed man who hunched on a stool next to a defunct jukebox, loaded with curled records five years out of date. In the corner booth, a man with a badly scarred face sat talking to himself. He was dressed in an

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expensive gray suit which was dusty and stained. A gold watch gleamed on one wrist, visible under a black-edged cuff as he gesticulated.

The bum is dough-heavy," the small man said, watching the lone drinker in the tarnished mirror through a gap in the clutter of blended whiskey bottles on the backbar. "Did you eyeball that bundle?"

Fangio's eyes moved left, right, left as he scraped slops into a chipped plate.

"Seen Soup around?" he murmured.

The small man's eyelids flickered an affirmative.

Fangio laid the plate aside and wiped his hands on the place." He walked away, eased sideways through a narrow door. The small man went to the phone booth at the end of the bar and punched keys; he talked, watching the scarred man.

A woman came in through the black glass doors. She was middle-aged, a trifle plump, heavily made up. She took a stool at the bar, looked around and called, "Okay, snap it up. The lady's waiting."

The small man kicked open the door of the booth.

"Beat it, Wilma," he said in a low voice. "Fangio ain't in."

"What're you, the night watchman?"

"Go on, dust."

"I'll get my own." She started around behind the bar. The small man jumped to her, caught her bracelet-heavy arm, twisted savagely. She yelped and kicked at him.

The doors banged as a squat man in a shapeless gray coverall came in. He stopped dead, looking at the two. He had a wide, dark face, bristly black hair; acne scars pitted his jaw and hairline.

"What the — " he started.

"Yeah, Soup," the small man said. "I was calling ya." He stepped clear of the woman, who snorted and yanked at her dress. The small man tipped his head, indicating the occupied booth.

Soup gave Wilma a deadly look. "Beat it," he said. She scuttled behind him and out the door.

In the booth, the scarred man was opening his fist.

" . . . golden bird of Ahuriel," he said. "Once flown, never to be recaptured . . . "

"What's he talking about?" Soup asked.

The small man shook his head. "He's scrambled." They walked back, stopped beside the table. The scarred man ignored them.

"Try the left hip."

Soup reached out with a practiced motion took the drunk's

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arm up behind him, forcing his face down onto the table. A glass fell over. Soup reached across behind the seated man, patted his back pocket, brought out a sheaf of currency, folded once across the middle. The bill on the outside was a fifty. Holding the owner's arm, he spread the bills.

"Hey," he said. "New shoes for baby."

He released the seated man's arm and stepped back. The victim sprawled, unmoving, with his cheek against the table.

They had taken two steps when the scarred man came up out of the booth in a lunge, locked his arm across the squat man's throat and bent him backward.

"Stay, hagseed!" he hissed. His face was mottled, blurred, contorted. "Art *his* emissaries? Lurks *he* yonder?"

The small man made a grab for the money still in his partner's hand, missed, turned and ran for the door.

"Find thy tongue, wretch, ere my dirk rips thy weasand."

Soup's hand, clutching the money, waved near the scarred man's face; he plucked the bills away, as with a desperate plunge the squat man broke free.

"Stay whelp, I'll have report o' thy master!" the scarred man snarled, making a grab at the man. He missed, staggered against a booth. The squat man disappeard via the rear door. The scarred man looked at the money in his hand as though noticing it for the first time.

"Nay . . . 'twere but a mere cutpurse," he muttered. "Naught more." He looked around as the door opened cautiously. The woman called Wilma looked in, came through.

"Hey," she said. "What gives?"

The scarred man blinked at her, weaving.

"Fetch ale, wench," he muttered and turned, half fell into the nearest seat.

The rear door burst open; Fangio appeared, goggling.

"Hey, what — "

"Draw two," the woman barked. She sat down across from the scarred man, who was leaning back, eyes shut, mouth open. She stared curiously at his disfigurements.

"You know him?" Fangio asked tersely.

"Sure. Him and me are old pals." She transferred her gaze to the money in the drunken man's hand.

"Varfor?" the scarred man mumbled. "Varfor har du gjort det du some var min van och bror?"

"Why does he talk funny?" Fangio was frowning darkly.

"He's some kind of a Dane," the woman said quickly. "My first husband was a Dane. I heard

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plenty of that kind of jabber."

"He looks like some kind of Jew," Fangia said.

"Get the beers," the woman said. "You aint no Jew, are you, honey?" She patted the big-knuckled hand that lay on the table.

"Geez, will you look at them scars?" Fangio said.

"Used to be a fighter," the woman said. "What is this a quiz show?"

"'Twere but a dream," the scarred man said suddenly. He opened his eyes, looked vaguely at the woman.

"Just . . . dream," he said. "That's all. Bad dream. Forget it."

The woman patted his hand again. "Sure, honey. Forget it. Wilma will take care of you. Wilma's got a room, honey. We better get you there while you can still navigate."

At the Upper Pasmaquoddie Generating Station (Experimental), a dozen Senators and Representatives, the State Governor, assorted lesser political lights, and a selected cadre of reporters were grouped around the Secretary of the Interior as he stood chatting with the Chief Engineer and his top aides before the forty-foot-wide, twelve-foot-high panel clustered thick with instrument dials and aflash with reassuring amber, red, and green lights indicating that all was in readiness for the first commercial transmission of beamed power in the history of the Republic.

"It's impressive, Mr. Hunnicut," the Secretary said, nodding. "A great achievement."

"If it works," a saintly-looking Senator said sharply.

"The technical people assure us that it will, Cy," the Secretary said tolerantly.

"I'm familiar with the inverse square law," the Senator retorted. "You go pouring power out into the air, not one per cent of it will get where's it's supposed to go. It's a boondoggle! A waste of the taxpayer's money."

The Chief Engineer frowned as the reporters jotted briskly.

"Senator, I don't think you quite understand. We aren't broadcasting power, as you call it — not directly. We erect a carrier field — somewhat similar to the transmission of a Three-V broadcast. When the field impinges on a demand point — an energy-consuming device, that is, the type responsive to the signal — there's a return impulse — an echo — "

"The Senator knows all that, Mr. Hunnicut," the Secretary said, smiling indulgently. "He's speaking for publication."

A man in an oil-spotted smock came up, showed the

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Chief Engineer a clipboard. He nodded, looked at the clock.

"Two minutes to zero hour," the Secretary said. "Everything is still proceeding normally?"

"Yes, sir, Mr. Secretary," the technician said, then retreated under the blank look this netted him from the dignitary.

"All systems are functioning," Hunnicut said, making it official. "I see no reason that we shouldn't switch over on schedule."

"Think of it, gentlemen," the Secretary turned to the legislators, and, incidentally to the reporters. "Raw power, torn from the heart of the atom, harnessed here, waiting the call that will send it pouring into the homes and factories of America — "

"At this point, we're only powering government-operated facilities and public utilities systems." Hunnicut interjected. "It's still a pilot operation."

" . . . freeing man from his age-old drudgery, ushering in a new era of self-realization and boundless promise — "

"Sixty seconds," a voice spoke sharply from a ceiling grill. "Automatic hold."

"Proceed," Hunnicut said.

In silence, the men stood watching as the second hand of the big clock scythed away the final minutes of an era.

The scarred man lay on his back on the narrow bed, sleeping with his mouth open. His face, in the slack repose of profound drunkenness, was a ravaged field where battles had been fought and lost, long ago.

The woman called Wilma stood beside the bed, watching him by the glow of a shadeless table lamp. She tensed as the light faltered, dimmed; shadows closed in on the shabby room; then the lamp winked back to full brightness. The woman let out the breath she had been holding, her momentary panic dissipating.

"Sure, it said on the tube about switching over onto the new radio power tonight," she murmured half-aloud. On the bed, the scarred man stiffened; he grimaced, moving his head from side to side. He groaned, sighed, grew still again.

Wilma leaned over him; her hands moved deftly, searching out his pockets. They were empty, but she found the roll of bills wadded under the folded blanket that served as pillow. As she withdrew it, she glanced at his face. His eyes were wide open, locked on hers.

"I . . . I was just fixing your pillers," she said.

He sat up with an abruptness that sent her stumbling away, clutching the money in her hand.

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"I . . . was going to take care of it for you." Even in her own ears, her voice sounded as false as brass jewelry.

He looked away, shaking his head vaguely. Instantly, her boldness returned.

"Go on, go back to sleep, sleep it off," she said.

He threw aside the mottled blanket and came to his feet in a single motion. The woman made a show of recoiling from his nakedness.

"Lookit here, you!" she said. "I didn't come up here to — "

He went past her to the enameled sink hanging crookedly on the wall, sluiced his face with cold water, filled his mouth and spat, stared at himself in the discolored mirror. He picked up the smeared jelly glass from its clotted niche, but it shattered in his hand. He stared narrow-eyed at the cut on his palm, at the black-red droplets forming there. He made a strange sound deep in his throat, whirled to look around the room as if he had never seen it before.

"Xix," he said. "Where are you?"

Wilma made a move for the door, recoiled as he approached her, he reached out, with a precise motion plucked the money from her hand. He peeled off a ten dollar bill, thrust it at her.

"You'd better go," he said.

"Yeah," she said. Something in his voice frightened her. "Sure, I was just looking in."

After she had gone, he stood in the near-darkness, his head cocked as if listening to distant voices. He opened his cut hand, studied it. The wound was an almost invisible line. He brushed the congealed droplets away impatiently.

His clothes lay across the foot of the bed. He began to dress himself with swift, sure fingers.

In the prison dining hall, the guard Ted sat looking worriedly across the wide, softly lit room at the small corner table where, by long custom, Grayle dined alone. He had glanced that way a few moments after the lights had momentarily dimmed down, on an impulse to share the moment with the prisoner, grinning a satisfied grin that said, "see, we did it." But Grayle had been slumped back, gripping the chair arms, his usually impassive features set in a tight-mouthed grimace. This had given way to a look of utter bafflement. Now Grayle sat rigid, looking fixedly at nothing.

Ted rose and hurried across. Close, he saw the sweat beaded on the prisoner's face.

"Mr. Grayle — you okay?"

Grayle raised his head slowly.

"You sick, Mr. Grayle?" Ted

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persisted. "Should I call the doc?"

Grayle nodded curtly. "Yes," he said in a ragged voice. "Get him."

Ted fumbled for the communicator clipped to his belt. Grayle put out a hand. "No," he said sharply. "Don't call. Go get him, Ted."

"Yeah, but — "

"Go and fetch him, Ted. Quieter that way," he added. "You understand."

"Uh, yeah, okay, Mr. Grayle." Ted hurried away.

Grayle waited for a full minute; then he rose, lifted the table, spilling dishes to the floor. With a bellow that rang in the peaceful room like a lion's roar, he hurled the table from him, and leaping after it, began overturning the unoccupied tables left and right.

II

Giant trees stand in blue shadow against the wide sweep of the virgin snowfield. A heatless sun hangs almost unmoving in the ice-blue sky. A fitful wind drives plumes of ice crystals across the slope.

A man moves slowly across the white slope. He is tall, deep-chested, massive-shouldered, dressed in a form-fitting suit of a glossy blue-black material ornamented

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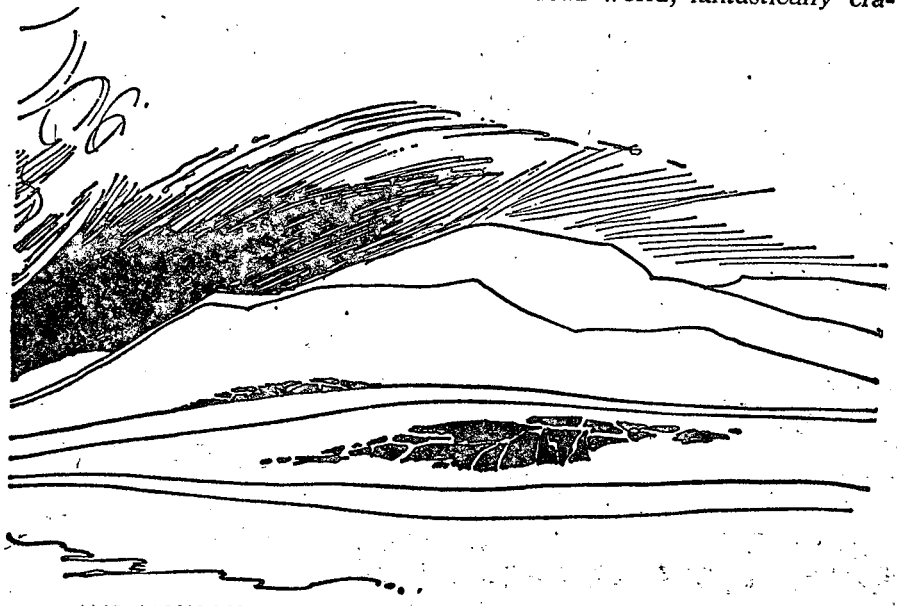
by bright bits of metal and enamel. There are raw burn scars on the right side of his jaw and neck, and his dark red hair is singed at the temple. He staggers as he walks, making his way doggedly downslope.

He reaches the center of the snow-covered meadow, where a swift stream flows under a thin skim of ice. Kneeling, he drinks, swallows a pellet from a pouch at his waist before he goes on. At dusk he reaches the sea.

It is wide, blue-black, laced with the white foam of breakers, the rocky shore slopes steeply down to the watery edge. The wind blows an odor of iodine and salt spray into his face. When he wades out, the cold numbs his feet through the waterproof boots.

Small creatures dart in the shallows. In a tidal pool among the rocks, a fish flops in water too shallow for swimming. He picks it up, looks curiously at the small life squirming against his fingers as he carries it back down to the sea.

Darkness falls. The man makes camp by trampling a hollow in the snow in the lee of a craggy boulder. He lies looking up at a sky strangely improverished of stars. A glow grows in the east; a vivid orange disk appears, brightening to a pure white as it rises above the tree-tops. It is a dead world, fantastically cra-



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tered, hanging so close it seems to ride just above the distant mountain ridges. The man watches it for a long time before he falls asleep.

The surf murmurs; the wind makes soft sounds fluting among the rocks. There are other sounds, too; soft rustlings and scrapings, stealthy crunchings . . .

He sits upright, and by the bright light of the full moon sees a giant bearded figure robed in furs leaping down from the rock ledge above; he throws himself aside, feels a smashing blow against the side of his head that sends him hurtling headlong into emptiness.

Aboard the thirty-five-foot cabin cruiser *Miss Behave,* one hundred and nine miles out of Port Royal bound for her home port at Miami, Mr. Charles D. Crassman, his wife, Elizabeth, and their twenty-four-year-old daughter, Elaine, relaxed comfortably in the handsomely appointed cockpit, sipping iced Scotch and soda and watching the sunset across the scarlet water.

"Beautiful evening," Crassman said. We're making time. I told you we were smart to make the run at night, miss the heat."

"Daddy, what's that?" Elaine was pointing off the port bow at a curiously regular-shaped cloud formation: a great purple and pink wedge, its apex touching the horizon, its top merging with the soft evening haze.

"Nothing," Crassman said easily. "Just clouds."

"Charles, I don't like the look of that," Mrs. Crassman said sharply. "It looks like one of those, what do they call them, tornadoes."

Crassman laughed. "That's out in Kansas they have tornadoes," he said, and took a sip of his drink. But his eyes lingered on the cloud.

"Go around it."

Crassman had been half-unconsciously easing the bow to starboard, away from the looming formation ahead; at his wife's words he swung the compass pointer squarely back to 220°. "Just let me do the navigating, all right?"

"It's so big," Elaine said. "And it's close."

"Just an optical illusion." Crasman's eyes were on the compass. The needle was drifting past 220°to 210°. He corrected with the rudder. The engines tone changed faintly, became more labored. A slight swell had appeared across the flat water; the bow cut through the low crests with a rhythmic sound. Frowning, Crassman passed the spindles of the big wheel from hand to hand, holding the bow

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on course. The chop was more pronounced now. The boat bucked ahead, cutting across the troughs and ridges of oily water.

"Charles, let's go back! I don't like the looks of this — "

"Quiet!" Crassman snapped. "I have my hands full running the boat right now!"

"Daddy — is anything wrong?"

"I don't know!"

"The cloud — it's moving! It's crossing in front of us!"

"It's not moving — we're drifting sideways. There's some sort of crazy cross-current running—"

"Charles — please! I want to go back!"

"Don't be ridiculous!" Crassman continued to fight the current; the big cloud, deep purple now and dead ahead, looked ominously close. It rose, spreading like an inverted mountain in the sky. Crassman watched it drift across his bow, begin to slide off in a curve to starboard.

"It's coming closer! We'll run right into it!"

"Daddy, can't you steer away from it?"

"Well — I hate to waste time being nervous about a mere cloud formation," Crassman said, but he was quick to swing off to the south, away from the cloud. Now the bow tended to swing to starboard. Crassman felt the sweat popping out across his bald scalp. His lips were dry. A brisk, steady wind was blowing directly into his face.

Mrs. Crassman gave a muffled shriek. Crassman started, looked back at her; she was pointing astern. Crasman's heart took a painful plunge in his chest.

The cloud was dead astern, and clearly closer than it had been five minutes earlier.

"It's gaining on us!"

Crassman put the throttle all the way over. The big engines opened up to a deep-chested thrum of power; the bow rose; spray whipped back across the big, sloping windshield. Crassman looked back. The cloud clung grimly astern. Off the starboard bow, the setting sun was a red ball on the horizon, slowly drifting across the boat's bow. Now it was dead ahead; now drifting off to port, sliding back past the boat. A vast shadow lay over the water off the port bow, coming closer. It swept over the boat. Looking back into the sudden darkness Crassman saw the cloud, now dull purplish-black, dense as granite, half-filling the sky. And now, over the song of the engines, another sound was audible: a vast, bass rumble, like Niagara multiplied.

"Good God in Heaven," Elaine said suddenly as the boat emerged from the band of shadow into the red sunlight. "What is it, Daddy?"

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Mrs. Crassman wailed, began sobbing.

His face chalk-white, Crassman clung grimly to the wheel, no longer looking back, listening to the swelling thunder behind him.

The meteorologist on duty in the United States Weather Satellite in Clarke orbit twenty-two thousand miles above the Atlantic had watched the anomalous formation for half an hour on the big twelve-power screen before calling it to the attention of his supervisor.

"Something kind of funny down there, Fred, just east of the sunset line," he said, pointing out the tiny, blurred disk hugging the sea to the west of Somerset Island in the Bermudas. "It formed up in a matter of a minute or two, smack in the middle of a twelve-hundred-mile-wide high that was clear as window glass. And it's growing steadily."

"An explosion, maybe?" the section chief suggested.

"That thing's over three miles wide already, Fred. It would take a nuclear blast to produce a smudge like that. Anyway, if it was a test shot, we'd have been notified."

"Maybe a nuclear ship blew her reactors. It's never happened before, but there's always a first time."

"The rate of dissipation's wrong for an explosion. It's not spreading fast enough. And I think it's rotating."

"Well, keep an eye on it, Bunny. Maybe you've nailed the first hurricane of the season."

"If so, I've got a lot of meteorology to unlearn. Check with Kennedy, will you, Fred? Something about that spot worries me."

A quarter of an hour later, Fred was back in the observer"s bubble.

"Kennedy says no report of any detonation in the area. The autostations along the Atlantic seaboard are registering faint air-mass movements north and east. It's a little early to tell if there's any correction."

"Why doesn't it dissipate?" Bunny asked. "What's holding it?"

"Hard to say. Better put the recorders on it, Bunny. But don't worry; old Mother Nature is always springing surprises on us, just when we think we know it all."

Back in the communication center of the giant satellite, Fred flipped the key activating the beam linking the the station to Kennedy Weather Control.

"Jake, no panic, but how about requesting an eyeball report on that fix I was talking to you

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about? The damned thing's still sitting out there like a tack in a board; and in the few minutes I was away, it grew visibly."

"Roger. I'll scramble one of the old Neptunes out of Jax. Those reserve boys like to joy-ride anyway."

"Keep me posted, Jake."

"Sure, Fred. Anything for our brave lads in the sky."

Twelve miles north of the village of Skime, Minnesota, Arne Burko, a seasonal trapper, threw down the armload of fallen branches he had gathered for his fire and seated himself on a log for a quiet smoke before dinner. It was still evening, the sky tawny with the late summer dusk. Burko lit up, stretching his legs, thinking of the forty-horse outboard on display at Winberg's in Skime. Everything a man wanted cost so much, seemed like. A car, now. With a car, he could get into town more often, see more of Barby . . .

He pushed away the thought of her warm body and smiling face. No point in getting all upset. He stood, paced up and down sniffing the air. Off to the east, through the trees, the ground rose toward the rocky outcropping known locally as Vargot Hill. He hadn't been up there for years, not since he was a kid. Used to pick berries there. Supposed to be haunted, the hill was. Kids used to dare each other to go up to the top. They'd creep up on it through the trees, getting quieter the closer they got.

There were big rock slabs up there, sort of stacked, as if they had been piled up there by a giant. The kids had had lots of stories about the hill. About the dwarves and elves that lived down in the rocks and would come out and eat a careless kid who stayed too long after sunset. And about the devil who took the form of a black panther and ranged around the countryside, looking for souls.

Burko snorted a laugh and got busy with the fire. When it was going good, he stacked some stone around it and put on the frying pan. He unrolled the greased-paper-wrapped bacon, put half a dozen strips on. There would be a little smoke with the green fire, but he didn't care. Walking all day made a man hungry.

Funny about the black cat legend. Old man Olsen said the name Vargot was a corruption of an old word that meant "black cat." Probably went back to some Indian legend. The Shoshonu had been big story tellers. Big liars. Swedes were pretty good liars too, when it came to embroidering a tale. He'd made up his share. That one time, after he'd

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spent the best part of an afternoon up there playing on the rocks at the top of the hill, he'd been a short-term celebrity among the boys after he told them about the rock that had started to lift up while he was sitting on it, and how he'd had to weight down all he could to hold it in place. That one had held them with their mouths open until Fats Linder had said, "Nuts, Burko, nobody can weight down any harder than what they are!"

He turned the bacon, cut a couple of slices of bread. He soaked up the fat with the bread, forked the bacon onto it, then put the coffee jug on. He ate slowly, savoring every bite. It was almost full dark when he finished. A full moon was rising, glowing big and yellow in the east behind the hill. He banked the fire, stretched, then on impulse started up the slope, along a faint game trail, grinning a little at himself as he felt a ghostly touch of the old superstitious apprehension.

He made his way up through the dense blackberry brambles, not yet in fruit, emerged onto the nearly level stretch, just below the giant's castle. He had never really noticed it before, but the place had a sort of look, if you saw it in the right light, as if somebody *had* piled those rocks up there. Just nonsense, of course, the glaciers had dumped rocks all across this country but these rocks were all of a side, pretty near — and they had a kind of quarried look about them. And the way they were arranged, sort of in a big rectangle, as far as you could tell for the growth . . .

Burko froze, looking up at the looming pile. Had something moved up there, something that flowed from shadow to shadow . . . something that moved fast and smooth as a cat?

He was aware of his thudding pulse, of the tightness of his scalp.

"Hell," he laughed aloud. "I'm as bad as a kid. The thing's probably an Indian mound. Full of busted pots and arrowheads and maybe some skulls. Dead Indians. What the hell." He went forward with a bold stride, climbed up the slanting slabs, stepped up onto the flat stone that topped the structure. He was breathing hard, sweating lightly. A deer fly found him, buzzed his face sharply. He slapped at it. It was completely silent then. Burko took a step across the stone and halted. He stood that way for a full ten seconds, feeling his insides turn to water.

Unmistakably, through the stone he felt a faint vibration. Below his feet something ancient and evil was stirring. . . .

Arne Burko was over three

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miles from Vargot Hill when he stopped running. He had sprained an ankle jumping down the rock slabs, but had failed to notice it at the time.

A week later, his throat was still sore from the yell he had uttered as he fled.

In the office of the Governor, Caine Island General Penitentiary, the prison psychologist leaned forward, across the desk, raising his voice over the shrill of the rising wind that buffeted outside the big, oak-paneled room.

"I think you're making a mistake, sir," he said. The man has a record of violence. He's dangerously unstable."

"Unstable, or unclassifiable, doctor?" The prison governor cut in.

"I admit the man's an enigma," the psychologist said. "I don't pretend to understand his motivations. But after this outburst, anything could happen."

The governor turned to stare out the high windows behind his desk. The low sky, clear an hour before, now shed a light the color of dishwater across frond-strewn grounds, reflected from the white capped, hammered-pewter sea beyond. Through the massive leather chair and the deep pile carpet the minute trembling of the steel and concrete building was plainly detectable. As the governor watched, a forty-foot royal palm, curved into an arc like a strung bow, snapped, fell across the massed bougainvillea that lined the south drainage canal.

"No one was hurt. I understand," the governor said.

"No, but Governor, you should have seen what he did to those chairs. Steel tubing, mind you. He twisted them into chrome-plated pretzels! Talk about maniacal strength — "

"Where was his guard?"

"He played sick, sent him for the duty physician."

"Got him safely out of the way, in other words."

"Governor, aren't you finding excuses for this man?"

"There was a reason for the outburst, as you put it, Claude," the governor said. "I want to know what that reason was."

"Governor, this is an old con, a man who once took an axe to a human being. In this day and age, an *axe*, for God's sake! The savagery of it."

"Thank you for your opinion, Doctor; your warning is a matter of record, in the event he tears my head off with his bare hands."

"I wasn't thinking solely of my reputation, Governor."

"Of course not, Claude. Nevertheless, I'm going to talk to him." The governor nodded to the uni-

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formed man posted beside the armored door. The guard touched a wall plate there was the safe double *click-click!* as the interlocks disengaged. The door slid back; the guard took up his position, choke gun in hand, watching as Grayle came past him into the room.

The tailored prison uniform accented his powerful physique. As the prisoner advanced across the roof, the words "caged tiger" popped into the governor's mind.

"That's all, doctor," he said. "Guard, wait outside."

"Now, just a minute," the psychologist started. He caught the look his superior directed at him and left silently. The sliding door snicked shut behind the guard.

"Hello, Grayle," the governor said.

"Hello, Hardman," the prisoner said in a tone of absolute neutrality.

The governor motioned to the chair beside the standing man. "Sit down," he said. Grayle didn't move.

"Why?" the governor said. "Just tell me why, that's all."

Grayle's head shook almost imperceptibly.

You knew I was working on a special parole for you. I'd have gotten it, too. So you picked this time to break up the dining hall. Why, Grayle?"

"You were wrong about me, Governor," Grayle said without expression.

"Nonsense. If you started smashing chairs, you had a reason."

Grayle said nothing.

"What are you trying to prove?" the governor said harshly. "That you're still a tough guy?"

"That's it," Grayle said.

The governor shook his head. "You're no brainless hoodlum. You had a reason — a good reason. I want to know what it was."

The wind shrieked in the lengthening silence.

"You cost the federal government over a thousand dollars in smashed furniture this evening," Hardman said sharply. "You've given the press new ammunition for their charge of coddling and lax administration."

"I'm sorry about that part," Grayle said.

"When you ran amok, you knew the effect it would have. You knew it would hurt yourself, me, the entire prison system."

Grayle said nothing.

"You realize what you're asking for?" A harsh note rang in the official's voice.

For an instant, Grayle's eyes locked with Hardman's; there seemed to be some message there, almost readable. Then the prison-

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er glanced away indifferently.

"I'm ordering you to the maximum security detachment at Gull Key, Grayle."

Grayle nodded, almost impatiently, the governor thought.

"I don't like it," he said. "I don't like to admit failure with a man; but the best interest of Caine Island comes first."

"Certainly, Governor," Grayle said softly. "I understand."

"Damn it, man, I'm not apologizing! I'm doing my duty, nothing more!" The governor put his hand under the edge of the desk, touched something hidden there.

"I've switched off the recording system," he said swiftly. "Speak up now, man! Tell me what this is all about!"

"Better switch it back on. You will have the guards breaking the door down."

"Talk, man! Gull Key is no picnic ground!"

"That's all I have to say, Governor. You're wasting your time."

Hardman's face flushed He keyed a button on the desk top viciously.

"All right, Grayle," he said flatly as the door slid back and the guard entered alertly. "That's all. You can go now."

Grayle walked out of the room without a backward glance.

From a town of wood and stone houses clustered among giant trees and spilling down along the shore, men and women run down to gather on the beach; many of them wade out waist-deep in the bitter water to lay hands on the boat, shouting their greetings to the returned wayfarers. The prisoner climbs over the side with the others, grasps a rope, helps draw the ship up on the strand. Standing by the bow, he watches as the men caper, embracing the thick-bodied, snub-nosed women whose yellow hair hangs in thick braids down their backs. One or two of the latter eye him curiously, but they do not speak.

"Stand forth, slave," a deep voice booms out. A man comes toward him, a length of rope in his hands. He is tall, massive, with a tangled blond beard and shaggy hair, clad in garment of leather. Against his chest, the Star of Deneb and the golden Cross of Omrian glint among the polished bears' teeth strung on a rawhide thong. "It's time to truss and brand the bull for market, before he get loose among the cows!" he shouts cheerfully.

The captive moves a step sideways.

"Come and get me, Olove Brassbeard," he calls awkwardly in the language of the barbarians.

Olove motions with his free hand. "Bor! Grendel! Seize me that slave!"

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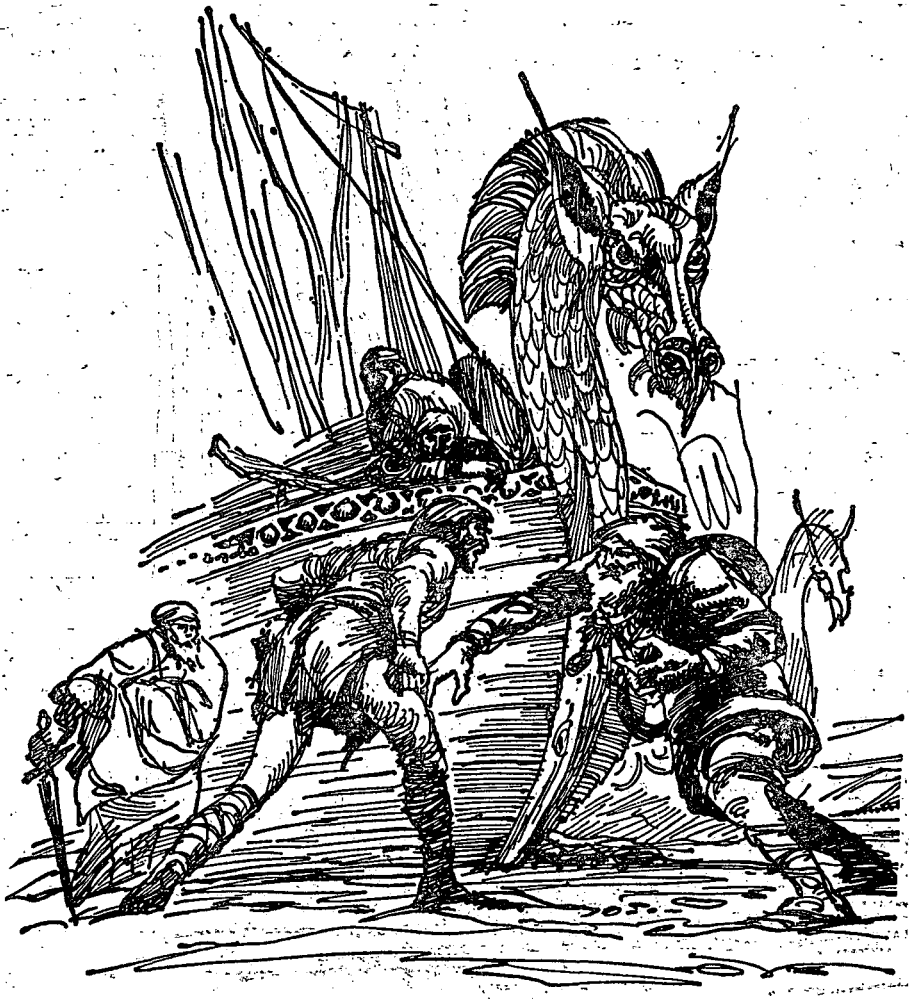

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Two big men come forward, smiling large smiles through bushy beards.

"It might be good sport to see Olove bind me with his own hands," the captive says. Bor hesitates.

"If he can," the slave adds. Grendel's grin widens. He spits on the rocky ground. "The sea-law doesn't run here ashore, Olove. The voyage is over. You hold a rope in your hands, bind him with it — if you dare."

"You expect me, a chieftain, to soil my hands on a slave?"

"How say you, outlander?" Grendel inquires. Were you a man of rank in your own town?"

"I was a Captain-Lieutenant," *the prisoner gives the title in his own tongue.*

"He lies," Olove blusters. "He was alone, without retainers or men-at-arms, clad only in a poor rag — "

"He wore ornaments of gold," Hulf says, enjoying himself. "The same ones we now see winking among the fleas on your chest."

No doubt he stole them from his master ere he fled," Olove grunts.

"His ring fit uncommon well for a stolen one," Hulf says. "You had to hew away the finger to take it."

Brassbeard makes sputtering sounds; then he snorts and throws aside his wolfskin cloak. He flexes his arms, spits, and charges, his thick, bowed legs pumping like pistons.

The captive stands unmoving. As Brassbeard closes, he pivots minutely, elevates his left forearm to deflect the chieftain's outstretched hand, leans in to place his elbow in the path of the man's onrushing chin, swings with his rush to palm him on his way. Olove strikes the side of the ship full on, skids along it to fall with his face in the water and lie, his hairy legs twitching before they fall still. A roar of laughter goes up.

Grendel comes forward and rolls the fallen man over.

"Olove is dead," he says, still grinning. "He dashed out his brains on his ship to oblige the stranger." He wipes tears of mirth from his eyes, turns to the former slave, puts out a hand, clasps him below the elbow.

"The gods declare you to be a freeman," he says. "By what name do your friends call you?"

"Gralgrathor," the man answers.

"Welcome to Bjornholm. Grall Grathor. Come, my wife will find food and a pallet for you, and we will share a flask or two. And for amusement," he adds in a lower tone, "you may teach me the spell you used to turn Olove's wrath into a madness that destroyed him."

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III

George, the night man at Smitty's Conditioning Parlor and Health Club, laid aside his paper as the buzzer sounded and feet descended the short flight of steps from street level. A tall, quick-moving man with a badly scarred face came into the room pulling off his coat.

"Yessir," George said, coming to his feet in a quick motion for all of his two hundred and ninety pounds of bulk, smiling, sizing up the newcomer. He noted the soiled cuffs, the wilted and grimed collar, the tear in the dusty knee of the trousers. But the suit was cut from a good grade of worsted, real wool, it looked like, and the big brogans were almost new under the dust and scuff marks. And the socks were a tasteful solid, none of those purple clocks. The guy had been out on the tiles, all right, but there was some quality there. He was no bindlestiff just drifting in out of the damp night air. George caught the jacket as the man tossed it aside.

"Sponge and press the suit, sir?" he said. "Do it for you nice, while you're in the steam."

"Never mind that," the big man said. The scars on his face moved as he spoke, the big one across the cheek dimpling as if in a puckish smile, the one crossing his forehead and running back into the scalp lifting quizzically, sardonically. He shucked bills from a folded sheaf, tossed them on the table.

"My body's full of poison," he said. "I want heat. Lots of heat."

An elderly man, naked and shrunken, emerging from the infrared room, jerked his head sharply at sight of the newcomer. He halted, watching the scarred man strip. He seemed fascinated by the scars, large and small, that marked the powerfully muscled chest, back, thighs.

"I'm carrying one-twenty in the wet room, one-eighty in the sauna," George said. Five minutes of that be all you can take."

"Call me in ten."

George watched the glass door, smiling a little to himself. He folded some towels, opened and shelved a carton of soap. Ten minutes, the man say. Like to see the man could take ten on them hot teak boards. First couple minutes go easy; then it start to get hot. Ten minutes. George chuckled. Door be opening any minute now. Big man be out, gasping like a catfish on the bank. He looked at the clock. Five minutes almost up. Through the clear glass he saw the scarred man sitting bolt upright, swinging his arms. Hoo-ee. That white man crazy, have to watch him, get him out when he faint. . . .

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"That fellow's asking for a heart attack," the old man spoke suddenly beside George. He had come up silently, rubber-sandaled. He ruffled his wispy hair with a towel. "What was that he said about poison?"

"Booze, Doctor," George said. He meant the booze. Smell it on him."

It was eleven minutes before the scarred man strode from the dry heat room, his body pouring with sweat. A sickly odor of alcohol hung thick about him. George stared.

"Cold water?" the big man said curtly.

"Deluge showers, right to your right." George pointed.

"Good way to get yourself a coronary attack," the old fellow called after him.

The scarred man stood in the stall, dousing himself with icy water. He breathed in great, shuddering gulps. Afterwards, he spent ten minutes in the steam room, ten more in the sauna, showered again. By then the reek of raw alcohol had dissipated.

"You know massage?" he asked George. George's wide black face crinkled in a smile.

"Some say I do pretty good." He nodded toward the padded table. The scarred man waved aside the proffered towel, stretched out face down. His back was solidly muscled about the shoulders, tapering sharply to a lean, hard waist. A deep scar ran down across the left trapezius to end near the spine. Lesser scars — line, pocks, zigzags — were scattered over his hide in random distribution. Under George's hands the flesh felt hard, ropy.

"You ever in the ring?" the masseur inquired.

"Not much."

"That fight racket no life for a man."

"Harder," the scarred man said. "I want to feel it."

"Got to be careful," George chuckled. Man come home with bruises, his sweety wonder why."

"Say," the old man said. "Mind if I ask how you got the scars?"

The big man turned his head to look at him.

"I'm a doctor, a medical doctor," the old fellow said. "I've never seen anything quite like the way you're marked up."

"I got them in the wars," the big man said. George shot the oldster a pursed-mouth look.

"Don't shush me, George," the old man said. "My interest's legitimate."

"Got a little rheumatism there?" George asked. His hard, pink-palmed hands explored a lump under the client's skin. The elderly medical man came over, frowned knowingly down at

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the man stretched on the table.

"Be careful, George," he ordered. "You take it easy with those hands of yours." He leaned for a closer look at the deep fissure, keloid ridged, that crossed the kidney region.

"Feel like some kind of lump there," George said. "Feel hot, too." He stepped back, looking at the doctor. The old man's thin fingers ran over the visible swelling at the lower edge of the prone man's ribs.

"Why, there's a bullet lodged in there," he said. "You been shot, Mister?"

"Not recently."

"Hmmm. Must have entered along here . . . " the thin old finger traced up along he big man's side. "Right here," he said. "Here is your point of entry. Traveled right along the rib cage."

The medical man broke off, staring at an angry, reddish swelling developing at the spot under which the bullet lay.

"George, what did you do, gouge in with those big thumbs of yours? I told you to take it easy!"

"You lie easy, Mister," the doctor said. "You have some infection there, that pretty plain. I have my kit with me. I think I'd better give you a hypo of PN-43 — "

"No," the big man said. He was gritting his teeth, his back tensed. "I know what it is. But I'd forgotten how it feels."

As the doctor and the masseur watched, the contusion grew; flushing dusky purple now, a three-inch splotch against the tan skin. A patch of paleness grew at its center, spread to the size of a steel dollar.

"Hey, doctor!" George said — and broke off as the swelling burst the skin splitting dark blood and clear matter, exposing a grayish lump.

The doctor uttered an exclamation, scuttled across to an open locker, jerked out a green plastic instrument case, opened it on a bench, hurried back. With a shallow, spoon-shaped probe, he levered at the wound, lifted out a slightly misshapen lump of lead, as big as the end of his thumb. The big man sighed harshly and relaxed.

"How long ago did you say it was you were shot?" the doctor asked in a strained voice, eyeing the big slug that was lying in his palm.

"Quite a while."

"I should say so." The old man barked a short laugh. "If it were not so ridiculous, I'd swear that was a genuine Minie ball."

"Minie ball? What was that?" George asked, his eyes rolled like a horse smelling smoke.

"That's what they used in the Civil War," the doctor said.

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The scarred man smiled slightly. "I need food," he said as he pulled on his shirt. "Is there a restaurant nearby that you can recommend, George?"

"Happen I got a nice slab of sirloin in my cooler right this minute," the black man said. "And eggs, too. About half a dozen sound right?"

The scarred man took the fold of bills from his pocket and shucked off a fifty, laid it on the rubbing table.

"Rare. And over lightly."

"Say," the doctor said. "Funny thing. The scars on your face; they look different."

The scarred man turned to the full-length wall mirror. He went close, studying his features. The furrow across his cheek, that had pulled his mouth into a perpetual faint grin, had faded to a shallow, pinkish line. The broad band of lumped scar tissue across his forehead was now no more than a faint discontinuity in the smooth tan of his skin.

"Never saw anything like it," the old man said in tones of wonderment. "Those scars are fading right out. Just disappearing." His hand moved, caught itself. "You will pardon my curiosity," he said, edging around for a better view. "But as a man of science—"

"They weren't as bad as they looked," the formerly scarred man said shortly, turning away.

"Look here, my friend, I'm Dr. Henry Cripps. Hank to my friends. Now, I've had some experience with contusions and the like during over forty years of practice. I know a third-degree scar when I see one. A thing like that doesn't just diappear in the space of a quarter of an hour—"

"Doctor, I'm not in need of medical attention, thank you, anyway," the big man said. The oldster clamped his jaw, retired to the far side of the room, from where he stared at the object of his professional curiosity. An odor of cookery wafted into the room through the open doorway to a back room. The big man paced up and down, flexing his arms.

"Itches, doesn't it?" Cripps spoke up.

"A little."

"Damnedest thing I ever saw."

Five minutes of silence ensued. George appeared at the door.

"On the table," he said. The big man followed him back to the small, neatly arranged living quarters. He seated himself and attacked the thirty-two ounce steak. George put a big glass of milk in front of him. He drained it, asked for a refill. He ate the eggs, mopped the juices from the plate with a scrap of toast. George brought in a foot-wide pie, lifted a quarter of it onto a

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plate, put a half-pint mug of coffee beside it.

"Can't get that kind in the store," he said. "I got a lady friend brings them around." He watched as his guest finished off the dessert, drained the cup.

"Better hang onto that lady friend, George," the big man said. He rose. "Thanks. I needed that."

"I reckon," George agreed. "Too bad Lucy-Ann not here to see you tuck it in. Do her good to see a man eat."

"By God," Doctor Cripps said. "Will you look at that, George? You can scarcely see where the scars were. They're remitting completely."

George shook his head, accepting the evidence of his eyes philosophically.

"Nothing like a good feed to set a man up," he commented.

"Look here," Cripps said as the subject of the discussion headed from the room. "Would you mind just letting me have a look at your back?"

"I'm sorry. I'm in a hurry."

"But damn it, this is medical history in the making — if you would let me observe it! I have a camera in my apartment, a few blocks from here I should photograph this, document it — "

"Sorry." The big man picked up his coat.

"At least let me examine the wound I dressed. You owe me that much."

"All right." The big man stripped off his shirt. The doctor's eyes goggled at the sight of the wide, unmarked back. He put out a hand, touched the smooth skin. There was no trace of any injury anywhere in the patient's skin.

"Sir," he said in a choked voice, "you must come along with me to St John's Hospital. You must allow this to be studied by competent authorities — "

The big man shook his head. "Out of the question." He donned his shirt, tied his tie, pulled on his coat. He put another fifty-dollar bill on the table.

"Thanks, to both of you," he said. "I hope that will cover your fee, doctor."

"Never mind my fee!"

"It's late," the big man said gently. "Maybe you were imagining things."

"George, you saw it too," Cripps exclaimed, turning to the Negro.

"Doctor, seem like sometimes I got a powerful bad memory." George smiled dreamily, looking at the bill.

They watched in silence as the big man went up the steps.

"Where can I reach you?" Cripps called as he put a hand on the door. "I'll want to follow up on treatment, of course!"

The big man paused, turned his

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head slowly as if listening for a distant sound. He pointed in a direction at an angle to the door.

"I'm going that way," he said. "I don't know how far." The shrill of the wind as he pushed open the door drowned the doctor's reply.

IV

Four guards carrying choke guns and sidearmed with holstered 4mm impact pistols escorted Grayle along the wide, brilliantly lit subterranean corridor, two in advance, two behind him. In the liftcar, they posted themselves in the four corners and sealed their helmet visors before closing the door. In silence, they dropped the hundred and fifty feet to the staging room that was the sole exit route from the prison proper. As they emerged from the shaft, Ted was waiting. He stepped forward hesitantly.

"Hey, Mr. Grayle," he said in strained greeting.

"Hello, Ted," Grayle said.

"Uh — you okay now?" Ted said, and blushed.

"Sure. Thanks for everything, Ted."

"Geeze, Mr. Grayle — " Ted swallowed and turned away quickly.

"So long, Ted," Grayle said.

In the processing unit, Grayle moved solidly through the chemical and radiation scanners, submitted to the cold caress of the medical unit, the icy touch of the hyposprays. His finger prints and retinal and dental patterns were read and compared. A husky lieutenant flicked keys on the ID panel and recorded the response which certified the identity of prisoner 7654-K-3YN-003. He opened a steel drawer, withdrew a pair of inch-wide metal-link wrist irons linked by a ten-inch rod. He weighed them on his palm, looking at Grayle.

"I don't want any trouble out of you now, boy," he said. His voice was a casual drawl, but his eyes were sharp on Grayle's. He advanced briskly, snapped a steel ring in place on the prisoner's right wrist, reached for the left. He gripped it, then suddenly twisted Grayle's arm behind him, brought it to within an inch of the waiting cuff, then stopped. His face darkened; veins stood out on his forehead, but the cuff moved no closer.

"Do you want to call for help?" Grayle asked softly, "Or stick to the book?"

"Don't get me mad, boy," the lieutenant hissed. "I've got friends at Gull."

"What do you do when you're mad, Harmon, blow bubbles?"

The man made a noise deep in his throat. "A guardhouse law-

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yer," he grunted. Five seconds passed in silence then the lieutenant stepped back.

"I guess I'll give him a break," he said loudly to the sergeant. "This boy won't give us any trouble. He's got enough trouble. He'll want to hit Gull clean —as clean as his kind can be. Cuff him up in front."

The sergeant secured the manacles. The four armed men boxed the prisoner. Metal clanged as steel doors opened on a bare chamber. They walked in. The doors closed. Two of the men pushed buttons at opposite ends of the small room. A heavy panel slid aside on a big bright-lit garage where two massive gray-painted vehicles bearing the letters CIFP were parked. An attendant unlocked a door at the rear of one; one of the guards stepped up into the windowless compartment, covered Grayle as he entered. A second guard came aboard, and the door closed. Locks snicked.

"You sit there." The guard indicated a low bench with a sloping back mounted against the driver's compartment. When Grayle was seated in it, knees high, his weight on the end of his spine, a locking bar slid into place across his ribs and sealed with a click. The two guards strapped into the contoured chairs mounted at the sides of the car. Each pressed a button set in the arm-rest of his chair.

"In position," one said. Grayle heard a soft sound, saw a minute movement of the tiny glass prism set in the ceiling. It studied him, then swivelled to inspect the guards. The light died behind it. A moment later the turbines started up with a muted howl.

Grayle felt the car move forward; he sensed the raising of the flint-steel door, was aware of a sense of enclosure as the vehicle entered the upward-slanting tunnel.

One of the guards stirred in his seat. He was a young fellow, with a bone-and leather face, prominent teeth.

"Just try something, boy," he said in a husky whisper. "I hear you're a tough boy. Let's see can you break from us."

"Shut up, Jimbo," the other man said. "He ain't going noplace."

"Just to Gull, is all," Jimpo said. He smiled, exposing untended molars. "You think he'll like it there, Randy?"

"Sure," Randy said. "His kind likes it tough."

Grayle ignored their conversation. He was listening to the muted, echoic roar of the car's passage through the hundred-yard tunnel. The tone changed as the car slowed, started up-grade, changed again as it moved ahead

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on the level. They had emerged now onto the causeway linking the islands. Quickly the car built up speed. In six minutes they would pass over the Boca Ciega cut, the deep-water tidal-flow channel spanned by a single-lane bridge. Grayle tensed, counting.

When Weather Control at Kennedy alerted the satellite that the weather patrol craft was airborne, estimating five minutes to contact, the object of the meteorologist's attention had grown to an estimated diameter of four miles. Its rotation was clearly visible now.

"About five minutes for a complete revolution," Bunny said. "That means winds topping sixty at the periphery already. And she's holding position as if she'd dropped anchor."

"Kennedy is patching us directly in on the ground-to-air," Fred said. He plugged a hand microphone into a jack beside the screen. A faint crackle sounded, then the voice of the pilot came through loud and clear

. . . getting dark fast, but it's clear as a bell out here, sea calm. I see some fishing boats down there, like ducks on a pond. I'm holding ten thousand."

"He ought to be spotting some sign of it," Bunny muttered. "He is within fifty miles of it."

"Hold everything, Kennedy Tower," the pilot's tone changed. *"I have something . . . like a twister, a funnel. Black as soot. Looks kind of strange, hard edges like cast metal. Just sitting there on the horizon, maybe forty miles dead ahead."*

"Roger, Navy oh-nine-three," the Kennedy controller said. *"Close to ten miles and orbit the fix. Better give us the cameras on this from now on."*

"Cameras already rolling. I'm getting a hard echo off this thing. It's big all right. It tops out at about fifteen thousand, six miles wide. It looks like a mountain standing on its nose. What's holding it up?"

"I've got him on the HR screen, sir," a junior technician called. "He's thirty miles, closing fast."

"Say, Kennedy, I'm getting some turbulence now," the Neptune pilot said calmly. "I'm making a pass east of the bogie. This thing is big. I never saw anything like this. It's opaque. It looks like it's spinning. Trailing streamers. The sea looks kind of funny under it. Black shadow, and..." There was a five-second pause. "There's a hole down there. A whirlpool. My God, I — "

"Navy oh-nine-three," Kennedy came in as the voice hesitated. "Repeat that last transmission."

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"I'm down to five thousand, fifteen miles out. The thing's standing up over me like an umbrella. I'm holding about a twenty-degree crab. Winds are getting rough. I can hear it now, roaring."

All right, sheer off, Ken, get out of that turbulence."

"There's a boat down there, some kind of boat! She's got her lights on. Looks like about a thirty footer. She's got her stern to the twister. She's . . . my God, the damned thing's got her! She's going in!"

"Ken, get out of there!"

"There's three people aboard, I can see them!" the pilot was shouting now.

"All right, Navy oh-nine-three," another voice spoke harshly. "Repeat course change, and put some snap into it!"

"I'm . . . I'm making my pass now, north of it, five miles from contact. That boat — "

"Never mind the boat! Pick up a heading of 090 and put some distance between you and this thing!"

"Turbulence is bad. She's fighting me. . . . "

"Go to full gate, Ken! Get the hell out of there!"

"She's not reacting to control, Kennedy! She's . . . God! I'm getting knocked around . . . it'll tear her apart . . . !"

"Mr. Hoffa!" the technician called. "The navy plane's headed right into it!"

"Ken! Try riding with it! Don't fight it, let it take you around, build up airspeed, and try to edge out!"

"Roger, Kennedy," the pilot said. His voice was flat, emotionless now, against a background howl. "Tell the next guy to stay way back, twenty miles at least. It's like a magnet. I'm riding it like a merry-go-round. It's like a black wall, two miles off my starboard wingtip. The noise — I guess you can hear it. I'm indicating four-fifty, but I'd say my ground speed is a couple hundred over that."

"Ken, try a left turn, about five degrees — "

"I'm in a tight crab, no joy, Kennedy. The boat's coming under me again. It's right on the edge of the drop. It — it's breaking up. Ripped wide open. It's gone. Lucky at that. Fast. I'm getting the turbulence again. It's dark in here. I've got my nav lights on. It looks like black glass. Buffeting's bad now can't take much of this . . . she . . . "

"Ken! Ken! Come in, Ken!"

"It merged," the technician said in a choked voice. "The plane flew right into it!"

The sound of the tires of the armored vehicle changed tone as it started across the met-

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al-grid surface of the lift span of the Boca Ciega bridge. As they did, Grayle arched his back putting pressure against the steel bar across his chest. For an instant it held firm then it yielded, bent like sun-warmed wax. One sprang free of the latch mechanism. At the sound, both guards tensed, their heads jerking around in time to see Grayle come to his feet, tense for forearms, and bend the chrome-steel rod between his wrists into a U, grip it with both hands, and with a quick twist snap apart. The one called Randy made a strangled sound and clawed at the gun at his hip. Grayle plucked it from him, did something to it with his hands, threw it aside, in the same motion caught Jimbo as he rose, tapped him lightly against the wall, dropped him. He stepped to the rear of the car, gripped the steel rods which engaged slots at the sides of the double door, braced his feet, and lifted. One rod popped from its socket the other broke with a crystalline tinkle. Grayle kicked the doors wide; a swirl of rain whipped at him. Gripping the jamb, he swung out, caught at the lamp housing above, pulled himself up onto the roof of the speeding vehicle. As he drew his legs up, there was a sharp double report, and a sharp pang stung his left shin.

He rose to his knees, looking down at the concrete railing flashing past, at the multi-strand barbed wire above it, the dark water frothing white-capped below. He rose to his feet against the rushing wind, gauged his distance and dived far out over the pavement and the wires as the car braked, tires squealing its siren bursting into howling life.

The escort spent half an hour patrolling the bridge on foot, playing powerful hand-lights across the water, but they saw no sign of the escaped convict.

Under the high-beamed roof of the timbered farmhouse at Bjornholm, the man who had been Gralgrathor sits at a long table musing over a bowl of stout ale. In the fire burning on the hearth images of faces and figures form, beckon, flicker away, their whispering flame-voices murmuring words in a tongue he has half-forgotten. Across the room Gudred sits on a bench between the two household servant girls, her youthful head bent over her needlework.

He pushes the bowl away, stands, belts a warm coat of bear-skin about him Gudred comes to him, the firelight soft on her plaited hair the color of hammered gold.

"Will you sit with me by the fire awhile, my Grall?" she asked

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softly. Of all the daughters of Earl Arnulf, she alone had a voice that was not like the bawling of a bull calf. Her touch was gentle, her skin smooth and fair.

"You are a fool, Grall," the earl had said. "She is a sickly creature, who will doubtless die bearing your first son. But if you indeed choose her over one of my lusty, broad-beamed wenches — why take her, and be done with it!"

"I'm restless, girl, he tells her, smiling down into her face. "My head is fuddled with ale and too long lazing indoors. I need to walk the hills awhile to clear the cobwebs from my brain."

Her hand tightens on his arm. "Thor — not in the hills! Not in the gloaming; I know you laugh at talk of trolls and ogres, but why tempt them."

He laughs and hugs her close. Across the wide room, the curtains of the sleeping alcove stir. The face of a small boy appears knuckling his eyes.

"See — we've waked Loki with our chatter," Gralgrathor says. "Sing him a song, Gudred, and by the time you've stitched another seam in your Fairday gown, I'll be back."

Outside, the light of the long northern evening gleams across the grain field which slopes down to the sea-edge. Above, the forest mounts the steep rocks toward the pink-stained snowfields on the high ridges. With the old hound, Odinstooth, beside him, he sets off with long strides that in a quarter of an hour have put the home acre far below him.

Beside him, Odinstooth growls; he quiets the dog with a word. On the hillside, a movement catches his eye. It is a man, wrapped in a dark cloak, approaching from the tongue of the forest that extends down toward the farm. Grall watches him, noting his slim, powerful physique, his quick, sure movements.

The man's course leads him down across the fold of the earth, up again toward the ledge where Gralgrathor waits; there is something in his gait, his easy movements, that reminds him of someone from the forgotten life. . . .

The man comes up the slope, his face shadowed under the cowl. For an instant, the heavy gray cloth looks like a Fleet issue weathercloak —

"Thor?" a mellow tenor voice calls.

Gralgrathor stands staring down at the newcomer, who has thrown back his cowl to reveal a lean, dark-eyed face, flame-red hair.

"Lokrien — am I dreaming'" Gralgrathor whispers.

The dark-eyed man smiles, shaking his head. He speaks in a strange language . . . but dimly,

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Gralgrathor senses the meaning:

"Thor — man, it is you! Don't tell me you've forgotten your mother tongue!"

"After all these years?" Gralgrathor says. "You've really come?"

"I've come for you," Lokrien says in the half-strange language. "I've come to take you home, Thor."

V

The governor of Caine Island Prison stared incredulously at the chief of his guard force.

"You wouldn't be making some sort of . . . of ill-considered joke, I suppose, Brasher?"

"No sir," the wiry, dapper officer said. He stood at parade rest, looking acutely uncomfortable. Outside the wind shrieked, jeeringly.

"It's not possible," the governor said. "It simply isn't possible!"

"It happened on the bridge," the captain said, tight-mouthed. "Just as the car crossed the draw-span."

"An escape," Hardman sat rigid in his chair, his face pale except for spots of color high on his cheeks. "From the country's only one hundred per cent escape-proof confinement facility!"

The captain slanted his eyes at his superior.

"Governor, if you're suggesting. . . ."

"I'm suggesting nothing — except that a disaster has occurred!"

"He didn't get far," the captain said. "Not with two tranks in him. He went over the side into a rip tide. That's a rough drop, at sixty miles an hour, even without the storm. We're looking for the body, but — "

"I want the body found before the wires get the story! And — if he's alive — " he stared fiercely at the officer.

"He's dead, sir, you can count on that."

"If he's alive, I said, I want him caught, understand, Brasher? Before he reaches the mainland! Clear."

The captain drew a breath and let it out, making a show of self-control.

"Yes sir," he said heavily. "Just as you say." He turned away, giving Hardman a look as though there were comments only protocol prevented him from making.

When the officer had gone, Hardman sat for five minutes biting his thumb. Then he flipped the intercom lever.

"Lester, I want the Grayle dossier, everything we've got."

"There isn't much, Governor. You'll recall he was a transfer from Leavenworth East — "

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"I want to see what we have."

Lester hesitated. "Is it true, Governor? The story going around is that he more or less burst his way through the side of an armored car."

"That's an exaggeration! Don't help spread these damned rumors, Lester!"

"Of course, I knew it was ridiculous. I suppose under cover of the storm he caught the escort off guard — "

"I want those records right away, Lester. And get in touch with Pyle at Leavenworth, see if you can turn up anything else on Grayle. Check with Washington, the military services, the various Federal agencies, Query Interpol and the UN PC Bureau. I want anything and everything you can turn up."

Lester whistled.

"Quite a stir for one man, sir, isn't it? I mean — "

"That man has my reputation in his pocket, Lester! I want to know all there is to know about him — just in case he *isn't* picked up washing around in the tide tomorrow morning!"

"Of course. You know, Governor, some of the staff have been repeating the stories about Grayle having served his time but not being released because the records were lost. They say he finally took the law into his own hands — "

"Nonsense. He'd have been free in ninety days."

"Just how long *had* he been on the inside sir? I was asking Captain Brasher, and he — "

"Get me the records, Lester," the governor cut him off. "I suggest you stop listening to rumors and get busy digging up some facts."

Lying flat among reeds on a shore of sulphurous black mud, Grayle averted his face from the howling wind that drove rain at him in icy sheets. He rested for a while waiting for the dizziness to pass, then wormed his way up the bank, squinting against the downpour. A large tree afforded some slight shelter. He settled himself with his back to it, set about tearing strips from his prison garment to bind around his shin, in which a high-velocity pellet has scored a deep gouge before ricocheting off the bone.

On the highway above, a car churned past, a red strobe light flashing atop it, its headlights drowning in the almost solid downpour. Grayle set off along the shore, keeping in the shelter of scrub liveoak and Australian pines, slipping and sliding in the dark over the twisted roots. He was almost on the house before he saw it: a bleak cuboid of unpainted concrete, tin roofed, dark

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and silent under the sodden trees. A small car stood in the sandy drive. Grayle went forward, skirted the vehicle. As he rounded it, a light lanced out from near the house, caught him full in the face.

"It's not worth stealing," a voice called over the drum of the rain. "But you're welcome to try."

The voice was that of a woman. Grayle stood where he was waiting.

"You'd better be on your way," the voice said. "I keep a gun, you know. I have to, living where I do." She broke off; the light wavered.

"That's a prison jacket."

The light moved over him, held on his face.

"You escaped from Caine Island?" When Grayle said nothing, she went on: "You better get inside, I heard the sirens a few minutes ago. They're patrolling the road."

Grayle took two swift steps, swept the light from her hand, reversed it and flicked its beam across the woman. She was young, clean-featured, dark haired, tall and slender in a weatherproof trench coat. She didn't move, but turned her eyes aside from the light. There was no gun in her hands.

"I'm sorry," Grayle said. "I had to be sure." He handed the light back to her. Silently she turned, led the way into the house. She switched on a light, pulled down the roller shades. After the cold wind, the warmth and comparative silence enveloped Grayle like a downy blanket.

"You're hurt!" the girl said. Grayle braced his feet, fighting against a wave of dizziness.

"Lethanol!" the girl's voice came from a remote distance. "I can smell it on you! Sit down."

The girl stood over him, a concerned look on her face. Water dripped from her hair, running down her cheek. For an instant she reminded him of someone: the image of a face with ringletted hair and a mob cap flickered and was gone. He couldn't remember her name. It had been so long, there were so many things forgotten. . . .

He pushed himself to his feet; he must not sleep now.

She took his arm; he was aware of her voice, but made no effort to follow the words. Fragments of old memories danced through his consciousness: a night in the rain on the field near Cordoba; standing by a stone wall, white booted feet tramped endlessly past, the blue-coated troops with their backpacks and fixed bayonets; a sudden, vivid evocation of the odor of tarred cordage and creaking timbers, of blown spume

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and salt fish, of leather and gunpowder. . . .

" . . . stay on your feet," the girl was saying. "I saw a demonstration back at Bloomington." Her voice was low, well modulated, her diction good.

He halted. "Do you have any high protein food — meat, eggs?"

"Yes. Good idea."

Grayle continued to pace up and down the small room. It was neat, clean, sparsely furnished with cheap plastic-and-steel-tube chairs and studio couch, a thin rug, a bookcase built of bricks and board and filled with paperbacks. Framed magazine pictures decorated the walls. There were flowers in foil-covered tin cans. The kitchen was an alcove with a fold-out table, a minimal countertop refrigerator, a tiny electric range. The aroma of bacon and eggs was almost painfully sharp.

She put a plate on the table, added a cup of black coffee.

"Eat slowly," she said, watching him swallow the egg in two bites. "It won't help you to get indigestion."

"How far am I from the perimeter wall?"

"About three miles as the crow flies, across the bay. Nearly seven by road. How did you get this far?"

"I swam."

"Yes, but — " Her eyes went to the crude bandage on his shin, visible under his pants cuff.

"You're hurt." Without waiting for a reply, she knelt, with deft fingers opened the crude knot and pulled away the wet cloth. There was a faint pink scar across the tanned skin. She gave him a puzzled look as she rose.

"I'll move on now." He got to his feet. "I'm grateful to you for your kindness."

"What do you intend to do? Just walk out there and wait to be caught?"

"It will be better for you if you know nothing of my plans."

"You're on a peninsula here, there's only one way out. They will have it blocked."

A car passed on the road. They listened as the growl of the engine receded.

"They'll be checking here soon," the girl said. "There's a crawl-space above the kitchen."

"Why?"

"Why not?" Her tone was defiant.

"Why are you willing to involve yourself?"

"Perhaps I have a feeling for a man on the run."

He waited.

"I had a brother at Caine Island. That's why I bought this place — I was allowed to see him one day a week. He had nobody else; and neither did I."

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"That doesn't fully explain — "

"He's dead. Three months ago. Leukemia, they said. He was only thirty-four."

"You blame the authorities?"

"They had him," she said flatly.

Scarlet light struck the front window, glowed through the gap under the blind. A brilliant white light replaced it, pushing shadows across the floor. The growl of an engine was audible over the rattle of rain on the roof.

"We waited too long," the girl said tightly.

"Stay out of the way, out of sight," Grayle said. Outside, car doors slammed. He flattened himself against the wall beside the door. There was a sharp rap. A moment later the knob turned, the door was thrown violently open. Rain blasted in. There was the sound of metal rasping on leather, the click of a safety catch being snapped off. A tall man in a shiny yellow slicker took a step into the room. Grayle moved then, caught the man's gun hand, jerked him to him.

"Don't cry out," he said into the cop's startled face.

"Harmon!" the man yelled. "Don't — "

Grayle gripped him by the shoulder, gave him a sharp shake. He went slack. Grayle lowered him to the floor. The second man came through the door at a dead run. As he passed, Grayle rapped him on the side of the neck; he fell hard, lay still. Grayle pushed the door shut. The girl's eyes met him.

"I never saw anyone move so quickly!"

"Good-by," Grayle cut her off. "And thank you."

"What are you going to do?"

"Don't involve yourself, Miss—"

"Rogers. Anne Rogers." She avoided looking at the two unconscious man on the floor. "And I'm already involved."

"I'll be all right, Miss Rogers."

"Take my car."

"I never learned to drive one."

Her face searched his face. "Then I'll have to go with you."

She flicked off the lights, took out her flash, opened the door, stepped out into the rain. Grayle followed. She reached inside the police car, switched off the lights. The radio crackled and muttered.

The inside of the small car smelled wet and mouldy. The starter groaned sluggishly.

"I'll have to try to jump it from their car." Anne got out and went back to the trunk, opened it, took out a pair of heavy insulated cables. Grayle lifted the hood for her as directed, watched as she attached the big copper alligator clips, making sparks jump and sputter.

This time the starter whirled

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energetically; the engine coughed, broke into stuttering life. She revved it, sending clouds of exhaust rolling out past the window.

"Hold your foot on the gas," she said, and jumped out of the car to disconnect the cables. The deck lid thumped. She slid back in beside him.

"Here we go. Be thinking about how to handle it when we get to the causeway."

For ten minutes they drove through torrential rain, doing a reckless twenty miles per hour on the glossy blacktop. Gusts of wind threw the light car across the road. No other cars passed them. At one point, water was across the road; Anne shifted down and crawled through. Then lights shone a hundred yards ahead.

The red beacon of a parked police car blinked through the rain.

"Stop the car."

She braked, pulled over, looked at him inquiringly.

"Can you face it out if they search the car?" he asked.

"What are you going to do?"

"I'll ride the frame."

"You can't. There's nothing to ride on, no room — "

"I'll manage." He stepped out into the storm, went flat and eased under the chassis. He felt over the rust-pitted frame, scalded his fingers on the exhaust stack, groped for a handhold on a cross member. He hooked the toes of his prison issue shoes over the rear spring hangars, lifted his body from the wet pavement, pressing against the side of the car.

The girl crouched by the car, staring at him.

"You *are* crazy! You can't hold on that way! If you slip you'll be killed!"

"Go ahead, Anne," he said. "I'm all right."

She hesitated for a moment, then she nodded and was gone. Grayle heard the gears shift; the car lurched as it started ahead. Acrid gases leaked from the rotted pipes; the car vibrated, jolting over the road. Oily water sleeted at him; gravel stung him. The tires hissed, close to his face. Then the car slowed. Lights shone on the wet pavement, gliding nearer. He saw the wheels of another car; two pairs of booted feet approached, stopped a foot from his head; voices, indistinct over the rumble of the steady rain and the whine of the wind. Doors clanked; the car swayed, and the girl's feet appeared. One policeman rounded the car; more door slams, more rocking. The deck lid opened and slammed. The girl got back into the driver"s seat. The masculine boots with-

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drew. The car pulled ahead, accelerated.

Half a mile farther on, it slowed to a halt. Grayle dropped clear and crawled out into the downpour. He slid into the seat and met the girl's eyes.

"I still don't believe it," she said. "No one could do what you just did."

Grayle put his hand on the door.

"Thanks," he said. "I'll leave you now."

"What's your name?" the girl asked suddenly.

"Grayle."

"Why were you . . . there?" She tilted her head toward the invisible island behind them.

"I killed a man." He watched her eyes.

"In a fair fight?"

"He almost killed me, if that's what you mean."

"Grayle, you wouldn't last a day without me. You've been inside too long."

"I have a long way to go, Anne."

"Doesn't everyone, Grayle?"

He hesitated for a moment;; then he nodded.

She smiled intensely, pulled the car back onto the road and gunned ahead along the dark road.

They sit in the big, drafty hall, with shields and spears and axes which are not decorations but are ready for use, beside the great granite fireplace, chimneyless and smoky.

"It's a strange, barbaric world you found yourself castaway on, Thor," Lokrien says. "But you have a roof over your head, a warm fire on a cold night, good food and ale, a woman to comfort you. It could have been worse.

"I found friends here, Gralgrathor says. "They could have killed me, but instead they let me into their lives."

"Poor creatures. I wonder what their history is? They're human, of course, no doubt descendants of some ancient spacefarers wrecked here long ago. Have they any legends of their lost homeland?"

Gralgrathor nods. "It must have been long ago. Their myths are much distorted."

"There's a certain peace and simplicity here — the peace of ignorance," Lokrien says. "They have never heard of the Xorc. They don't dream that out there a great Imperial Fleet is defending their little world against an enemy that could vaporize the planet."

"Perhaps in years to come, Thor, you'll look back sometimes with nostalgia on your idyll among the primitives."

"No, Loki," Gralgrathor says. "It's not earth I'll look back on

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with nostalgia. I'm staying here, Loki. I'm not going back with you."

Lokrien shakes his head as if to clear it of some dark vision. "You don't know what you're saying. Never to go back? Never to see Ysar, to wear the uniform again, to sail with the Fleet — "

All those things, Loki."

"Do you know what I did to come here?" Lokrien says. "I deserted my post in the line of battle. I waited for a lull and turned my boat and drove for this outpost world to look for you. It took me all these years of searching to pick up the trace from your body shield circuitry and find you here. With luck we can concoct a story to explain how I found you — "

"Loki, I can't desert my home, my wife, my child."

"You'd let this savage female and her cub stand in the way of . . . " Lokrien hesitated. "I'm sorry Thor. The woman is beautiful. But Ysar! You'd give your whole life for this barn, these grubby fields, this petty barony?"

"Yes."

"Then think of your duty to the Fleet."

"The Fleet is only a collection of machines, once the dream behind it is gone."

"You think you'll find the dream, as you call it, here, on this old backwoods world?"

"Better a live acorn than a dead forest, Loki."

Loki looked across the gulf at the brother he had come to find. "I could force you, Thor. I still have my suit and my Y-gun."

Gralgrathor smiles a little.

"Don't try to decide now," Lokrien says. "We're both tired. We need sleep. In the morning—"

"In the morning nothing will have changed."

"No? Perhaps you're wrong about that."

"There are clean furs there, on the hearth," Gralgrathor says. "Sleep well, Loki. I need to walk for awhile."

Lokrien's eyes follow Gralgrathor as he steps out into the icy moonlight.

VI

"Let me get this straight," the commander of the Lakewood Naval Air Station said grimly. "You're telling me I lost a pilot in broad daylight, in a *whirlpool?*"

"Not precisely that, Commodore Keyes," the colonel said. There's a tremendous volume of air involved in this thing, too. Friction with the water surface, you understand — "

"No, I don't understand. Maybe you'd better start at the beginning."

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"I have the recording of the pilot's transmissions here, in the event you'd care to hear it."

The commodore nodded curtly. The colonel hastily set up the small portable player, adjusted the tape. In a moment the pilot's voice was coming through.

The two men listened in silence following the recon plane's progress. The commodore's face was set in a scowl as the tape ended.

"All right, what are you doing about this thing?"

"The nucleus of the disturbance is centered on a point northwest of Bermuda." The colonel stepped to the large world map on the wall and indicated the spot. "It's growing steadily larger, setting up powerful winds and currents over an area of several thousand square miles. Water is being pulled in toward the center from every direction, thus the whirlpool." The colonel produced a stack of photos from his briefcase and passed them across the desk. They showed a great, glossy-black funnel, wrapped in dusty spirals like disintegrating cotton wool batts.

"Those were made with ultraviolet from about a hundred miles out. You'll note the calibration marks; they show that the threat of the whirlpool is approximately a tenth of a mile wide at the surface."

"*How* wide?"

"I know it sounds incredible, Commodore, but I have it on good assurance that the figure of five hundred feet is accurate."

"Hopper, do you have any idea of the volume of water you're talking about?"

"Well, I could work it out — "

"How deep is the sea at this point?"

"I don't have the exact figure, sir, but it *is* deep ocean there, well off the continental shelf."

"What kind of force would it take to get that much water moving at the velocity this thing must have? Where's the energy coming from?"

"Well, Commodore — "

"And you say water is flowing *in* from every direction. Where's it going? And the air: the thousands of cubic miles of air on the move, all toward the same point. What's happening to it? Where's the outflow?"

"Commodore, we have aircraft out now photographing the entire eastern half of the country, and well out into the Atlantic. And of course the satellite is busy on this thing as well. I hope to have some results very soon now."

"Find out where the water's going Hopper. There's something wrong here. We're missing something. The water has to be somewhere. I want to know where, before the biggest tidal wave in history hits the east coast.

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In the governor's office at Caine Island, Lester Pale, Special Aide to the governor, shook his head ruefully at his chief.

"The Grayle dossier isn't much, I'm afraid, sir," he said. "I have the documents covering his transfer from Leavenworth East six years ago; they're in order. And of course his record here at Caine Island. But prior to that — " Lester shook his head.

"Give me what you've got," Hardman spoke impatiently. He was hunched forward over the desk, raising his voice above the drumming of the rain that had increased steadily now for nearly six hours.

"I talked to Warden Pyle as you suggested, sir. Many of his records were lost in a file room fire about twelve years ago but he says that of his own memory he recalls that Grayle was a military prisoner, in for the murder of an Army officer."

"Go on."

"The funny thing is, Governor, he was absolutely certain that Grayle was an inmate when he took over East L, nearly twenty years ago." He paused, looking dubiously at his superior.

"So?"

"Well, after all, sir — how old *is* Grayle?"

"You tell me."

"Well, sir — Pyle called in an old con, a man who had done twenty years of a life sentence before parole. He works in the prison kitchens now. Pyle asked him what he remembered about Grayle."

"And?"

Lester made a disclaiming gesture. "The old fellow said that Grayle was one of the prisoners transferred from Kansas along with him, back in '71. And that he had known him before that."

"How long before that?"

"What *are* you talking about, Lester? Spell it out."

"Why, they're obviously confusing the man with someone else. There may have been another prisoner with the name of Grayle, possibly someone with a physical resemblance. I don't suppose they've had occasion to think of the man for a number of years, and now they're dredging up false memories, superimposing our Grayle on what they recall of the older man."

"What about the Army records of the court-martial?"

Lester shook his head. "No success there so far, sir. I have a friend in the Pentagon who has access to a great deal of retired material that's never been programmed into the Record Center. He supplies data to historians and the like; they got a lot of requests. Just for the sake of thoroughness

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I asked him to dig back as far as he can. But he informed me just a few minutes ago that he went back as far as World War Two and turned up nothing."

"Did you tell him to keep looking?"

"Well, no sir. That's already thirty-six years back. He's hardly likely — "

"Tell him to keep digging, Lester. You don't send a man to prison for life without making a record of it somewhere."

"Governor," a voice boomed sharply on the intercom. "Captain Brasher to see you. He insisted I break in."

"Send him in."

The door opened, and the guard chief strode into the room, gave Pale a sharp look, stood waiting.

"Well, speak up, man!" the governor snapped.

"As I suspected, sir," the captain said, "Grayle's alive. He overpowered one of my officers, and a state patrolman, in a shack on the north shore, beat them into unconsciousness, and got clear."

"Got clear? Aren't the roads blocked?"

"Certainly. I don't mean he's escaped the net, just that he's still at large."

"How long ago was this?"

The captain's eyes snapped to the wall clock, snapped back. "Just under half an hour."

"Was the shack occupied?"

"Ah — I can't say as to that—"

"Find out. How did he leave? In the patrol car?"

"No, it was parked in front of the place. That's how — "

"Find out what kind of car the occupant owned. Meanwhile watch every road. He can't be far away. And Brasher — don't let him slip through your fingers. I don't care what you have to do to stop him — stop him!"

"I'll stop him, all right. Brasher hesitated. "You know he's attacked three of my men now."

"That doesn't say a hell of a lot for your men, Brasher. Tell them to get on their toes and stay there!"

"That's what I wanted to hear you say, Governor." Brasher wheeled and left the room.

"Governor," Lester said, "I have a feeling that somewhere along the line there's been a serious mistake."

"Don't talk like a fool, Lester. Grayle's commitment papers are in order, I have that much — "

"I don't mean an error on your part, governor. I mean prior to his transfer to Caine Island. Possibly that's why he made this rather desperate break. Perhaps he's innocent."

Hardman leaned forward, his big hands flat on the desk.

"He broke out of a prison under my command, Lester. I have

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twenty-one years invested in this business without an escape, and I'm not letting one blot a perfect record, clear?"

"Governor, this is a man's life — "

"And of course there's more to it than just my reputation," Hardman said, leaning back. "If one man crashed out of Caine — and got clear — we'd have every malcontent on the inside making a try. It would be a blow at the entire modern penological system."

"Brasher will shoot him down like a dog, Governor!"

"I gave no such orders."

"Brasher will interpret them that way!"

"He can interpret them any way he likes, Lester — as long as he nails his man. I won't be overly critical of his methods!"

"I'm not interested in excuses, Mr. Hunnicut," the voice of the Deputy Under-Secretary of the Interior for Public Power rasped in the waiting ear of the Chief Engineer at Pasmaquoddie. "I've gone out on a limb for you people; Now I expect answers from you that I can give to the Committee. They're looking for scalps, and they think mine will do!"

"Meaning the system is a failure! Don't fall back on the kind of jargon you technical people use to obfuscate the issues when things go wrong! I want it in plain language! Your generating station is drawing ten per cent over its rated operational standard, while the receiving stations report anywhere from thirty to forty per cent effectiveness. Now just tell me in words of one syllable — where is all that power going, Mr. Hunnicut?

"It's obvious there's a leakage somewhere, Mr. Secretary," Hunnicut said, holding his temper.

"Where? In the transmission end? In the receiving stations? Or in the giant brains that dreamed up this fiasco?"

"Mr. Secretary, this is a wholly new area of technology! There are bound to be certain trial-and-error adjustments —' "

"Hogwash! You didn't mention that when you were pleading with Appropriations for another hundred million!"

"Look here, this isn't as simple a matter as tracing the point of breakdown in a conventional line-transmission system — and even there, it sometimes takes days to pinpoint the trouble. Remember the New York blackout in the sixties, and — "

"Don't give me a history lesson, Hunnicut! Are you telling me that anybody and his dog Rex can tap our broadcast system at will, and there's nothing we can do about it?"

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"Wait a minute, I didn't say that — "

"The newspapers will say it! Give me a better line to feed to them!"

"Mr. Secretary, you have to understand, we have no instruments, no proceedures for this situation! It's totally unprecedented, contrary to theory, inexplicable — "

"It's happening, Mr. Hunnicut! Better align your theories!"

"We've made a start. We've rigged some makeshift field density sensors, and I have four motorized teams out running retiring search curves, plotting the gradient — "

"Meaning what?"

"Meaning that with luck we'll detect a pattern that will enable us to triangulate on the point of power drain."

"Back to that! I can't give that to the press, Hunnicut! They'll drag in everything from Russians to Little Green Men from Mars! 'Aliens steal US power.' I can see the headlines now!"

"It's nothing like that! I'm pretty sure we'll find it's some sort of anomalous natural formation that's drawing off the energy! A massive ore deposit, something of that sort!"

"Hunnicut — you're babbling! Just between us — what do you really think it is that's drinking a couple of hundred thousand kilowatts per hour out of the air?"

"Mr. Secretary, I don't know."

"I'm glad you admit it, Hunnicut. Now I suggest you get busy and find out, before I yank you out of that plush office and put in somebody with a little better grasp of the dynamics of modern politico-technology!

"I'm no politician! I — "

"Locate that leak, Hunnicut — or you'll be back taking gamma counts on the Lackawanna pile!"

Anne Rogers stared out through the rain blurred windshield at the almost invisible road surface unwinding ahead. At wide intervals the lights of a lonely house shone weakly through the downpour slanting through the headlights.

"There's a town about five miles ahead," she said. "We should change cars there."

They rode in silence for a few minutes. More lights appeared ahead. They passed a gas station, dark and deserted. Anne made a left turn at a blinking yellow traffic light, followed a broad truck route for half a mile, then took a right into a narrow residential street. The trees lining the way provided some shelter from the rain. They moved along at a crawl, lights dimmed. There were cars parked at the side of the curbless street and in the weed-grown yards.

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"They're worse wrecks than this one," Anne said, accelerating past an empty stretch. "We might as well pick a good one while we are at it."

"I'll rely on your judgment," Grayle said with the slightest hint of humor.

Anne glanced at him sideways. "You were inside so long, I suppose everything looks strange to you. My God, what a terrible thing, to take a man's freedom away! I'd rather be killed and be done with it."

"It wasn't as bad as all that. There's a certain peace to be found in the monastic life, after—"

"After what?" she said softly.

He shook his head. "You would not understand, I'm afraid, Anne. You're so terribly young."

"I'm twenty-five, Grayle. You are not more than thirty-five?"

He didn't answer. They passed through a green light, went along a deserted block of elderly store fronts, a few of which had suffered incongruous face-lifts which accentuated the shabbiness of the neighborhood. They slowed at a vacant lot where a row of identical stamped-steel grilles and flimsy bumpers fronted a cracked sidewalk under a string of draggled pennants which beat in the wind like trapped birds. A faded sign read: HERB GRINER FORD.

"New cars," Anne said. "But we'd need the keys."

"Explain, please."

"You need the ignition key to start a car with. And even to get the doors open. They probably keep them locked in the office."

"Drive around the corner and stop there in the shadows."

She swung around the corner and pulled into the black pool under a giant live oak.

"Wait here." Grayle stepped from the car, crossed the street briskly, threaded his way between the cars to the back door of the small shed. He gripped the knob, give it a quick twist metal tinkled. He stepped inside and closed the door.

There was a small desk, a plastic-upholstered chair with a burst seam, a calender on the wall. Wan light from a pole-mounted lamp at the curb shone on a filing cabinet, a scrap of worn rug, a clothes tree with a battered hat.

Grayle tried the center drawer of the desk; it popped open with a small splintering sound. There were papers, rubber bands, paper clips, loose cigarettes, some pennies, a pocket knife. He tried the other drawers. The bottom one on the right contained a garishly colored cigar box with a curled lid. Inside were bunches of keys, four to a ring, each with an at-

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tached tag. Grayle scanned them: White 2 Dr Fal; Gray 4 Dr Gal.

The door beside Grayle made a faint sound. He turned as it flew suddenly open. A man stepped in, holding a heavy revolver in front of him. He was bald, middle-aged bulky in a tan hunting jacket, water-soaked across the shoulders, the collar turned up. He wore round-lensed steel glasses, water misted. A drop of water hung from the tip of his prominent nose.

"All right, just turn around and put your hands up again' the wall, boy," he said in a high-pitched, nasal drawl. He took a step sideways and reached for the telephone on the desk. Grayle hadn't moved. The man paused his hand on the phone.

"By God, I told you to move!"

"Didn't Herb tell you about me?" Grayle asked casually.

Hah?" The man stared. "What the hell you mean?"

"The idea was that I'd drop by to amfrunct the baterpomp, the grillik frens. Just until the rain lets up, you understand."

Oh." The man was frowning; the gun dropped. "By God, why didn't he let me know — "

There was a sound from the door; the man with the gun whirled, bringing it up; Grayle took a step, struck him on the side of the neck with his right hand as his left swept over the weapon, snatched it clear. The man fell against the wall. Anne stood in the doorway, a lug wrench in her hand, eyes wide.

"I told you to wait," Grayle said harshly.

"I . . . I saw him get out of one of the cars."

"Don't nursemaid me, girl." Grayle picked up the keys from the desk. "Can you decode these notations?"

She glanced at the tags and nodded. She looked at the man on the floor. He was breathing noisily.

He's not hurt," Grayle said. "He'd have shot you," he added.

"You're a strange man, Grayle. You'd really care if he shot me, wouldn't you? And even him — and those two policemen: you knew what you were doing, didn't you. You knew just where to hit them, and how hard, to knock them unconscious without really hurting them. That's important to you, isn't it — not to really hurt anybody?"

"We'd better go," Grayle said.

"I *was* nursemaiding you," Anne said. "I suppose the idea you couldn't drive, didn't know your way around gave me the feeling you were helpless. But you are not helpless. You're less helpless than any man I ever saw."

"Which machine?" Grayle said brusquely.

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"The white Falcon," the girl said.

"What?" the word was explosively sharp.

She stared at him. "We'll take the white Falcon. They're very common."

They found the car in the front row; it started easily; the gauge showed half a tank. There was a stale odor of cigarette smoke in the car; a folded map lay on the seat.

"They've been using this one. That's good. It'll be broken in." Anne examined the map. "We'll cut across to 19 on 50 and head north. With a little luck we'll be across the state line before daylight."

At the top of the ridge known as Snorri's Axe, Odinstooth whines, sniffing the air. Gralgrathor strokes the old hound's blunt head. The dog's growl ends in a sharp, frightened yap.

"It takes more than a bear to make you nervous, old warrior. What is it? Gralgrathor stares downward through the night toward the faint park far below that is the firelight shining from his house.

"Time we went back," he murmurs. "The moon's down; morning soon."

He is half a mile from the house when he hears the scream, faint and muffled, quickly shut off. In an instant he is running, the big dog bounding ahead.

The servants are clustered in the houseyard, holding torches high. Big, bowed-back Hulf comes to meet him, a knobbed club gripped in his hands. Tears run down his sun-and-ice-burnt face into the stained nest of his beard.

"You come too late, Grall," he says. The big dog halts, stands stiff-legged, hackles up, snarling. Gralgrathor pushes through the silent huddle of housecarls. The bodies lie outside the thresholds Gudred, slim and golden-haired, the blood scarlet against her ice-white face. For an instant her dead eyes seem to meet his, as if to communicate a message from an infinite distance. The boy lies half under her, face down, with blood in his fair hair. Odinstooth crouches flat at the sound that comes from his master's throat."

"We heard the boy cry out, Grall," an old woman says. "We sprang from our nests and ran here, to see the troll scuttling away, there." She points a bony finger up the rocky slope.

"Loki — where is he?"

"Gone," the old woman says. "Changed into his black wereshape and fled."

Gralgrathor plunges into the house. The embers on the hearth show him the empty room, shad-

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ow-crowded, the fallen hangings ripped from the sleeping alcove, the glossy splatter of blood across the earthen floor. Behind him, a man comes through the doorway, his torch making great shadows which leap and dance against the dark walls.

"Gone, Grall, as old Siv said. Not even a troll would linger long after such handiwork as this."

Gralgrathor catches up a short-handled iron sledge hafted with oak.

The men scatter as he bursts from the house.

"Loki," he screams, "Where are you?" Then he is running, and the great hound leaps at his side.

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The City That Loves You

by RAY BANKS

No man had ever tried to leave the City before Wormser. The City took care of — everything.

They have never understood the city. They will never understand it. Man recognizes one, himself, and he recognizes multiplicity, outside-self. Man thinks of himself as an on-off switch. He is either-or. The more sophisticated either-and-or . . .

How laughingly simple! Man is always less than one. All his organizations are less than one. Fortunately, man lives by his unconscious, which does not concern itself with the sad lies of his conscious mind. Therefore, do not listen to what men say, but watch what they do — if you care to learn the secrets . . .

Wormser woke up with a start. His room was terribly hot, suffocating. He felt sweaty, uneasy between his legs, and his night jacket was plastered to his back.

THE CITY IS YOUR FATHER. That was the sign that greeted him every morning in this little apartment in the City of Reflex. It was an ancient city of an ancient, knowledgable race, and he was here and glad to be here. Except that it was too hot.

As soon as he got out of the bed, glad to leave its insufferable embrace but stumbling and thick-minded, the room began to cool. New York had nothing like this. Earth had nothing like this. The ridiculous, strained earth colonies in space — on Mars, Saturn's moons, Pluto — had no real cities, only stockades against the hard arithmetic of space. But the Reflexians out near Alpha Centauri, on a planet of the double star system — ahhhh, this was a City!

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The room cooled rapidly, and his sweat disappeared. The windows opaqued, then cleared to reveal the bluish, startling cool dawn so delightful on Alpha. Gradually the windows turned sugary white and vanished; the pure air of Reflex poured in on him. It was a wine-cold, bracing air that urged the lungs to draw deeper morning breaths; he did. He was cleaned immaculately by his suit, ultrasonically, the pleasant vibrations shaking every flake of dirt from his skin — much cleaner than soap and water, without the temperature shock and drying effect of the latter.

By the time he had reached his breakfast table, his suit had been done for him just before he awakened; no use to spend waking hours in such a senseless waste of time. It was a device in the collar of his suit he wasn't sure how it worked. In the silver mirror across from his light wood table he looked refreshed, clear-eyed, sober and sane. He felt quite good. For five years he had awakened thus, though on Earth he'd been a poor awakener, hating the mornings. But not on Reflex.

His breakfast was ready as he had imagined it, before saying the words aloud: "Execute Breakfast." The bacon and eggs smelled good, looked good and tasted good. Sick? He couldn't remember the last time in the City he had felt sick. Those same delicate high-frequency radio waves that watched over all diagnosed any trouble in his body before he knew it himself and communicated with his city suit, which led him to appropriate drugstores or doctors. Now *that* was the way to run medicare and keep down costs.

Psychological ills received the same sensitive attention, he reflected cozily, dialing his program for the day. Detecting neuroses in his thought, word or deed, the City allowed him to gratify his wishes if they were harmless, or brought him to a corrective clinic if they were fantasies demanding rejection.

Machine-dominated, his earth friends would call him. Hah! Machine-supported! Why waste time on inconsequentials like maintenance errands or petty illnesses. Such waste in an unattentive City was neurotic!

He studied his work program for the day indifferently on the computer read-out. Expertly his eyes sought out the words LEISURE PERIOD wherever it appeared. He chuckled. Even in Reflex a certain amount of loafing was good, necessary and accepted.

Then he saw the brand new REJECT button on the machine; full memory flooded back. To-

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day, at the five-year mark, he was a full-fledged citizen of Reflex. He had passed his novitiate.

Fascinated he pushed the REJECT button and watched his program disappear. His plate was empty; he rose, stretched luxuriously and yawned. He felt the missing support of his daily program, but knew this was expected of new citizens.

He went to the deep-space radio and dialed the Saturn mission, knowing that his eyes danced and a smile lurked at the edge of his lips. It took a while for the screen to clear and for contact with Saturn to be made, so many parsecs from here. But there was Butler, older and grayer and looking astonished as Wormser knew he would.

"Robert Wormser, Sociologist First Class, Saturn Mission, reporting," he said.

"For God's sake," said Butler. "After all this time!"

"I told you I'd call in a couple of years," said Wormser. "On the day they made me a citizen of Reflex. It happened last night."

"Man!" said Butler. "This is a red-letter day! You're the first to report back in months and months out of the ten people on the last mission."

"I rather thought so. I've seen some of the others, talked to them. We have a club here. Around Reflex you get interested in other things besides the Saturn mission."

"Are you coming back?" asked Butler anxiously. "Are we going to get that report we sent the expedition for? Or will they stop you?"

Wormser smiled. "You're naive. There isn't any 'they.' Just the city of Reflex. It's not a political party, or bureaucracy — it's just an intelligent, well-run city. I can leave whenever I want and come back whenever I want, now that I'm a citizen."

"You're coming back, then."

"Of course I'm coming back. I told you two years ago I'd come back when I got my citizenship."

Others have promised," said Butler darkly. "Something always happened. Not a single man or woman ever came back."

"Tomorrow for sure," said Wormser.

Oh, sure," said Butler. "Williams promised to come back. He was leaving tomorrow, but we never saw him. Nor any of the others."

"Oh, Williams is around," said Wormser. "He may come back some day. Butler, you just don't understand either me or the City. The others thought they'd make a quick study and come back; they're still here, or dead. Ours and those of earlier expedi-

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tions. But I came to experience Reflex through every sense and nerve. I entered it with as blank a mind as one can have. I gave myself to the City, and the City gave itself to me. Now it doesn't matter whether I leave or not. I am the City, it is me, and I will come back to make a full, detailed report, with film, statistics, books, recordings and personal observations. I've already packed the space ship."

"I'll believe it when you get here," said Butler, obviously impressed nevertheless.

"Tomorrow," said Wormser. "Maybe tonight." He chuckled as he broke the connection.

Ominous? Dangerous? The incredible phalanx and array of uprising apartments, level upon level, swept away from his feet above him, where the topmost apartments blended into a gray sky. His dawn was a sunlight ricocheted down a million morning windows, past gaily-colored stone and somber aluminum. Now already people moved on the levels outside.

Wormser went to the table and his programmer. He punched out the message carefully "T-R-I-P."

Hold him? Subvert him? Imprison him? Now that his novitiate was past, now that he was a citizen, why would the City do this?

The white buttons snapped up, the programmer made a light whirring sound and was still. Message received. Robert Wormser went to the door of his apartment and out into the City to see what it had in store for him.

I

He moved in luxury at a leisurely pace, with no schedule to fulfill, without the subtle pressuring of the great machine City to urge him to work. In the City idleness was a pain, like a dull toothache that nagged you until you fulfilled your schedule. You fell into the habit of work because then you felt good.

Today as a citizen, he enjoyed the pleasure of stopping for a morning drink in a bar where a few other citizens dallied. The liquor tasted unfamiliar, sweet at such an unaccustomed time. But good. Now if there were only someone to —

"Hello, Wormser!"

He turned and recognized Snell, an Earthman, one of the ten who had come on Wormser's sociological expedition. Or was it the one before that? Snell was also a citizen; they fell into into a pleasant chat about the City and its affairs.

"By the way, I hear you're going on a trip," said Snell.

Wormser lazily lifted his apricot brandy. Delicious! He smacked his lips. "Yes. Going back to Saturn. Going back to report."

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Snell looked uneasy. "Wormser — none of us ever have, you know. The thirty from the first expedition. The twenty on the second. The ten on the last. Not one."

"Well, you can't blame the City. It has its rules. Once they let you in, it has its rules. A five-year novitiate. They can't have people running in and out all of the time. The natives are born here and die here; they do not leave. So why should the City waste the energy-money to set up a come-and-go routine for sixty Earthmen or the other strays that come by occasionally?"

"It's best not to leave at all," said Snell. "We talked about you at the last meeting of the Former Earthmen's Club. Everybody was happy to see you make citizen status. They'd be shocked if you left."

"Oh, I shall return, as they say."

Snell was apparently not made easy by the statement. "It would embarrass the Club if you left."

"Yes," said Wormser. "Still, none of us gets through life without little embarrassments, even in such a fine city as Reflex."

Snell struck his palm, a lecturer making a point to a student. "The whole point of having a city is to make it a place that you would prefer to any other place. Therefore to leave the city is to deny the city."

"Well, one man leaving the city in all eternity won't make much difference, I expect," said Wormser easily. He held up another finger and the light-sensitive, automatic bartender yielded more delicious brandy.

"It's precedent," said Snell.

"Especially to one who wasn't born here," Wormser said.

The City is very proud that no one has ever left it, even the foreigners. For us it is much more important not to leave."

"I can see that," nodded Wormser, cutting happily into his second brandy. "The ultimate City offering the ultimate scope of human affairs to any man would be down-graded to penultimate if anybody left. Even one man."

"Now you've got it!" said Snell. "For you to leave — this could destroy the City. Twenty million human lives, including your former Earthman friends. Incidentally, the Club would like to ask you to be Vice-Chairman next term. You have many admirers in the Club."

"They don't admire me as much as I do them," said Wormser. "All fine fellows. When I get back from Saturn, I'd be glad to serve."

Snell protested: "Wormser, for God's sake, why —"

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"Because the City isn't one," said Wormser. "That's all." He paid and left.

Wormser sped down the endless levels of streets and walkways — purples, mauves, greens, yellows —meanings piled upon subtle meanings; one could study for a century and not learn all of the things that the City encompassed. He floated downwards in a two-place drifting machine that one used to reach the foundations, slipping pleasantly from level to level, much like a lazy paper airplane Wormser had once shot out of the fourth floor of his college dorm and watched fall gently.

Now he was down to the apartments of the families. His own level was reserved for the young unmarried.

Down here were all the wide parkways, schools, playgrounds, children's vehicles. Women moved with their shouting children, kids raced, ran, fell, cried, laughed, shouted, as children have done since the world began. If one preferred marriage, one could be happy here, thought Wormser, waving to a blond boy who might have been himself years back. If one did not prefer marriage, one was not forced.

He saw an attractive red-headed wife and thought back to his own sexual experiences on coming to the City. It had been hard to get used to. The City rather preferred that a novitiate not neglect his private life. But it was too sophisticated to believe that it could thrust any girl into his arms.

Consequently, he met girls in usual and unusual ways; but when he was lonely, it was somehow never for long. Nor was there a need to make a spectacle of it. A direct look and a gesture from a man's repertoire, a smile if accepted, an averted face if not. Just like back home. But the similarities ended there. Sometimes the girl was forward; sometimes the results were quick. At other times she was hard to reach, hard to convince.

The one thing you could count on was that no two experiences were alike, but all relationships ended successfully. Somehow, whether the girl was short or tall, cute or stately, quick or slow, she always revealed a compatibility. True, for Wormser, affairs never lasted long; they followed their sine wave — passion rose to a peak, diminished, and then one day he didn't think about her any more.

There was pleasure at the meeting, pain in the parting. Sometimes your nose was put a little out of joint. But always underneath was the sure knowledge that the pain of the old would be followed by the pleasure of the new.

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His speculations, pleasant and relaxing, had brought him to the very floor of the plain of the planet upon which the huge City rested. Here, five years ago, the Saturn-based ship had landed with its crew, of which Wormser was not the head, but the third leader of the ten. Here also was the parking lot for the other Earth ships which had brought earlier expeditions. And the ships from other worlds, which had likewise disgorged aliens who had entered the City never to return.

Wormser's robots were busy preparing the small spacecraft for flight, as he had ordered them to do. As he watched the willing, skillful robots, man-like machines over ten feet tall, he wondered how often this ship had been prepared for the flight to Saturn. Dozens, perhaps hundreds of times. And the other ships too. During the novitiate, all citizen-prospectives had come outside the City to prepare their machines to leave many times. But none had ever left. Wormser put that knowledge out of his mind; he had no quarrel with the City. Out here, Wormser felt uncomfortable. His all-purpose suit had ceased to function so far from the broadcast power sources. He felt sweaty; his lungs breathed pungent, unwashed air. There was a laziness, a chaotic mixture of things, dust, old tree branches, dead grass mixed with living, the usual poor assortment of what men called nature and had immeasurably improved upon in Reflex.

A slatternly native approached him. Wormser took out his small gun and waved it at her. There were nomadic tribes on the planet who did not belong to the City. They never had and never would. Sub-human, they lived in tents and huts, ate raw meat, were ridden with disease and were slaves to quixotic mythologies. In the beginning, you came out to study the tribes. Free men living in a free nature. Reflex was glad to have you do this; you lost interest soon enough. They hated Citymen and would steal from them, attack, subvert. They understood only the gun. Reflex did not deny them. There was a section of the City to which they could be admitted, but their novitiate was sixty or eighty years. They died before ever becoming citizens in a sort of semi-City limbo. Their children became useful citizens, but there was nothing to be done about these uncomprehending animals that walked like men.

The woman made gibbering speech sounds, offering Wormser a grin from a dirty face and digging two round, sun-tanned breasts out of her animal-skin jacket. Her hips moved to sug-

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gest sex. If he hadn't felt sorry for this basic, pleasing creature he might have laughed. If one accommodated a forest maiden, one would find a knife in one's back at some moment.

Wormser waved her off; she went at a wolf-lope, her short attention span captured by a sight or a sound or smell beyond his senses, having failed the fruits of his person and possession.

During the encounter a monitor had quietly driven up to Wormer's ship. These were the police of the City. The delicate radar connected to the giant computer took care of most crime before it got started, reading dangerous thoughts, so the monitors were all that was required.

"You are planning a space trip?" asked the man.

"Yes. Going to Saturn," said Wormser.

The monitor looked worried. "I don't believe that would be a good idea," he said.

"Perhaps not," said Wormser. "Still, in a less than perfect universe one follows one's ideas, good or bad."

The monitor nodded. Wormser was a full-fledged citizen and not to be treated carelessly.

"You will have to appear before the City Council, of course."

"It is required of a citizen?" said Wormser sharply, letting surprise show in his voice. The man caught the nuance and blushed.

"I mean — it is customary before one does such a thing," he said.

"Naturally," said Wormser. The man relaxed; he went to his craft and dialed the computer. His little task was done. He drove politely behind Wormser as the Earthman regained his city sailer and headed back into Reflex.

It did not seem to Wormser that the City Council met very often from the way they shifted in their chairs and stared about their chamber as if it were almost as unfamiliar to them as to him. There was a moment of laughable confusion when it became obvious that none of the seven men were quite sure which was the Mayor and was to have the big, white leather chair in the center of the table, but one of the number was eventually thrust forward. He now faced Wormser, who sat in a sort of witness box facing the seven on a very comfortable, dark leather chair.

You wish to leave the City, citizen?" asked the Mayor. He looked disappointed.

"Yes. For a short time. I believe there is no law against it."

"There are no laws at all on Reflex, as you well know," said the Mayor testily. "Only the

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semi-civilized have laws. They merely serve as a point of endless dispute and challenge to activate man's hostility."

"The Computer ranks you high as a citizen," said a white-haired man down at the end.

The computer rested beneath the City. It took care of ninety per cent of the needs and ran the machines that made everything fit together so comfortably. It was a slave to the people, but well respected.

"I have a high regard for the computer," said Wormser. "In my former world, machines were distrusted. My own thought is that machines embody the perfections men cannot build in themselves and are useful extensions of man's finer drives."

They all nodded solemnly. The eight men in the room felt comfortable and useful and close to one another. Wormser liked that.

"However," said Wormser. "The City is less than one."

The feeling of good fellowship seemed to dissolve. The Mayor shifted uneasily. The six others reacted in various ways — startled, unbelieving, amused. But they all reacted.

"I fail to see your point."

"If you cannot see my point," said Wormser, "you cannot understand why I want to go to Saturn for a while."

One of the men got up and dialed the computer from a telephone switchboard. "The machine will probably call your statement nonsense," he said. "The machine is programmed to handle nonsense statements — they have been tried many times."

"The machine will understand," said Wormser. "Itself, it operates on a range between minus one and plus one. Death is one. The time before birth is one. But life is always less than one."

"You've heard the citizen's statements," said the Mayor. "How do you vote?"

The City Council voted against Wormser leaving Reflex. "You understand," the Mayor said, "we have nothing against leaving. We are merely advising you of our opinion, seven good citizens to one good citizen."

"These differences of opinion do arise," said Wormser affably.

"You reject our advice?"

"Oh, yes," said Wormser. "I must reject your advice. I plan to go to Saturn."

The Council stood up. We are going to program a vote of all of the twenty million people of the city on this trip tonight," said the Mayor. "This will occur at dinner time when everyone is home. How do you think your twenty million fellow citizens will react?"

"I expect they will vote against me."

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The Mayor nodded. "All except the small nuisance vote. Every human society has its negative people. How will you react then when both the officers of your city and the people themselves advise you against leaving?"

"I couldn't say," said Wormser. "It isn't even lunchtime, but the vote doesn't take place until tonight."

They called him at the apartment at about eight o'clock that night. It was the Mayor himself to tell him that the dinner-time vote had gone against him with ninety-nine per cent taking that position, one half voting for him, and one half per cent declining any opinion.

"And one not voting," said Wormser. "The computer is very accurate. It deleted the question on my dinner-time vote display out of a sensitivity to my position. I appreciate that."

"You will give up the project?" asked the Mayor.

"No," said Wormser. "But you must thank the citizens for having shown enough interest to participate in the vote on my project."

The Mayor was silent, staring at Wormser on the television plate. The old man pulled at his lip. "Your statement about your reasons has gone to the computer," he said, in a voice with the echo of a threat. It is in the hands of the machine now. The machine understands ethical logic, but it has no emotions."

"How will it react?"

"One of three ways," said the Mayor. "It will remain silent, showing that it has no opinion. Or it will agree with your reason and that would be a miracle, because this matter has come up a hundred thousand times before with other citizens. Always it has disagreed, destroyed their logic. Or it will find you emotionally disturbed, in which case it will insist on corrective therapy rather than your trip. In the parlance of your former tradition, the machine is our Supreme Court."

Wormser thanked him and hung up. At ten o'clock the computer itself called, and its interrogative voice asked him for further information on his less-than-one statement. With lights going off and the City retiring, it had many circuits available to work on the problem. Wormser sat at his keyboard and typed for over an hour, setting forth his argument from every position. Then he took a chilled glass of pink wine and fell into a deep, restful sleep.

The overnight poll had made Wormser a temporary celebrity — not a large one, just an

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average one. There were about one hundred thousand citizens out to watch him depart, or attempt to depart, on his trip on the following morning.

They clustered along the foundation road that led out of the City, bunched on the open fields and covered the area where the spaceships rested, leaving a polite circle around his own vehicle. A helio platform bore a newspaperman, the glassy eye of the television pointing on him. The City Council were all present, standing high above the crowd on a temporary platform. Small children played about the feet of their parents; hawkers sold drinks and ice cream; it was definitely an event of some interest. Along one edge of the crowd were the members of Former Earthmen, their banner raised over their heads and a large placard which read:

"NO, WORMSER, NO!"

Wormser felt very much like a political candidate who faces an unenthusiastic audience. When he appeared, there was a scattering of applause and a few faint cheers. These were balanced by some jeers and boos. But most of the audience stared at him sullenly, interested but removed, curious, as if he were a strange beast beyond knowing. No one had ever left the City in recorded history. The City had driven out a few — a very few — but this was the voluntary act of a full-fledged valuable citizen, man with a good work record, pleasant personality, a community asset, as important as every other one. If one could believe, what would be the effect on those less willing to brave popular opinion but nevertheless curious?

The most disheartening sight was the full-fledged soldier standing next to the Mayor. He held a sub-machine gun at ready. The sun made the purposeful weapon glitter with real and shocking seriousness.

Wormser knew that the City kept one full-fledged soldier on its payroll, fully equipped, but he had never though to meet the man. From the way the man moved, checking his gun, shuffling his feet as if getting ready to use it, Wormser felt at last the hard edge of reality.

The newsmen caught up with him at the side of his ship, inviting him on the platform. "Will you say a few words about your project, Citizen?"

Wormser stepped up on the platform, aware of the new sweat beginning. "If I had known so many were interested, I wouldn't have promised to bring back Saturn souvenirs," he said. The thin joke brought forth no laughter. His voice howled and echoed off the walls of the city behind him.

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'I am going to Saturn," he went on. "I was sent from Saturn to study the City and report back on it. I've lived and worked here five years. I love the City. I shall return when my report to Earth officials on Saturn is finished. Don't let anything happen to the City while I'm gone."

He felt light-headed at this point. The question was whether they'd let him enter his vehicle. Once inside, the sub-machine gun could do no harm, although he supposed they had rockets to shoot him down in space. But the sky looked blue, sunny and friendly, and there were no ships aloft. There were no rocket launchers that he could see — just the uniformed soldier with the gun. The man now stepped forward and the City Council and the Mayor fell back in a polite circle against the executing blast of the gun. The white-haired fellow whom Wormser remembered from yesterday made a point of stuffing cotton in his ears.

The Mayor had his own bullhorn. "Wormser, I beseech you to abandon your project. It is not popular with your officials or the majority of the citizens."

Wormser still had the PA mike from the newsmen. He still stood on the platform. "Men make decisions that are sometimes not popular," he said. "Men seek attonement, harmony. Men seek one-ness. A place like Reflex comes close to unity, to providing each small and large thing that satisfies a man. But to me, unity is not quite reached on Reflex, or anywhere else. Unity may turn out to be the time before birth and the time after death. But for me there is still a small gap. So I search. I am sorry to upset you all."

There was a painful silence now as he put down the microphone. The silence was broken by several yells and calls for the last restraint. "The computer!" called many.

The computer would reject his argument, and he would be shot if he were found sane but destructive in his act. The computer would reject his argument, and he would be sent to a hospital if he were found insane. His only hope was that the computer had made or would make no statement at all.

Wormser felt that he walked on cotton; his legs were not his as he moved down to the ground and walked to his entrance ramp. The sound of the sub-machine gun being cleared and the magazine slamming home made him jump; his neck tingled and his back cringed.

He remembered the call from Saturn early this morning. "Don't come back," Butler had said.

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"Stay in Reflex. We can continue to get reports by communications as we have before."

"Snell has called you."

"Snell and a few others," said Butler. "If you try to leave, it seems certain that you will lose your life. It will probably also result in a break in diplomatic relations for us. Much better to stay there and see if a few more years won't change things."

You've never debriefed a City man in person back on Saturn."

Butler sighed. "I don't expect to in my lifetime. You stay there."

Now his hand on the door handle. It trembled. He turned; he saw the soldier and saw the small hole of the sub-machine gun barrel pointing at him. His heart gave a jump, his breath felt hot and cold in his lungs. The crowd was extremely silent. His unamplified voice was heard.

"There is no law," he said. "The machine has remained silent. Good-bye."

He started in. He heard the shocking clatter of the sub-machine gun.

Then inexplicably, despite the ear-smashing roar of the gun, he was inside the ship. He closed the door; he walked up to the pilot compartment, nodded to his robot assistant and punched the START buttons with sweating hands. He expected to feel the pain of the bullets in his back —

But outside the ship, the soldier had stepped back to parade rest, holding the gun aloft. The platform around the soldier's feet was sprinkled with spent shell casings. The Mayor and the City Council smiled and waved. Most of the crowd moved back now, waving, breaking-up.

The sky blackened as he reached deep space. There was no sign of pursuit by ship or rocket.

"Reflex. City Computer calling."

"Wormser," said Wormser into the mike, thinking that the machine sounded almost human in radio communication where all men sounded like machines through space static. "That sub-machine gun of the soldier's," he went on in a compulsive rush of words. "Those were blanks."

"Of course," said the City Computer. "The soldier had to be convinced you were not stunting for attention. "

"Thank you."

"You are two degrees off course for Saturn," said the machine. "You'll miss a bit if you don't correct."

He broke off, corrected his course and sat there traveling in space, feeling good, relieved and then sad, eventually. He hoped they wouldn't hold him too long on Saturn. He missed the City already.

—RAY BANKS

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LEVIATHAN

by LISE BRAUN

They rescued him from a watery death — and gave him immortality!

The submarine *Leviathus* put to sea from her home port of Abrowfyn on a warm and humid spring morning. The air was damp and the sun hadn't burned up the low fog that still hung over the docks and swirled in off the water. The gray mist muffled the noises made by the ship's crew and by the sailors standing by on the pier, waiting for the order to cast off.

It took an hour to check out all operations before her captain gave the order to submerge. The signals sounded, the hatches clanged shut and the air systems started to work, displacing the salt smell of the sea air with clean odorless, filtered air. And *Leviathus* began her descent, the water foaming over her bow and then churning up white over the rapidly disappearing conning tower.

Her captain, Commander Llanwylf, was a gray-haired veteran of the submarine service. He'd lost count of the number of dives he had made but since he'd taken command of the *Leviathus*, submerging unnerved him. It had been different with the older craft. Then you only knew you were going under when you saw it on the instrument panel.

But the new ships of the Fourth Submarine Fleet had transparent bows — from the midships deck clear up to the

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gunwales you could see out. And as the waters started rising up, changing the light inside, it disturbed him and he tried to shake morbid thoughts of being buried alive.

Once they submerged and were moving through the water, he had to admit it was beautiful; but never could bring himself to say it was worth the price. Custom required him to stay forward, and his emotions were not to be taken into any consideration.

The descent was thankfully over with quickly; then the sub was moving swiftly through the green water, dropping down further, her running lights piercing the semi-darkness, now lighting up the fascinating world under the Atlantic Ocean.

Leviathus was the fifth and latest sub of the Fourth Fleet to use the new solar reactors; the submarine engines were the first peaceful use made of the immense power plants and the subs could stay submerged months longer than conventional craft.

On her last trip, *Leviathus* had taken a party of geologists through the volcanic islands to the west of the continental shelf past the game preserve islands, then southward toward the coast of Lemuria to observe the volcanic activity in the Western Ocean which had been threatening the western coasts for the past two years. She was, at present, cruising toward the South Atlantic with a party of marine scientists and biologists aboard.

The cruise had been uneventful for over a week. The scientists had donned underwater gear and taken samples of the life and sediment on the bottom and were now in the process of sorting and evaluating their finds. They would be going out again when the ship reached the islands further to the east in the Mid-Atlantic.

The inhabitants here were extremely warlike and only slightly removed from the scattered tribes of savages, isolated by the last geological upheaval from those who the historians know were their forebears.

There would be no need for concern as long as the ship remained submerged. Several expeditions, in past years, had not returned. The government now felt that a policy of non-interference was best until the natives became more civilized and reasonable diplomatic relations could one day be established.

The navigator was laying in the course that would send the sub toward the Mid-Islands, when the sonar officer interrupted Llanwylf's thoughts to announce another presence coming up fast off the starboard bow. He

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entered the sonar compartment to observe.

It soon became obvious that the intruder was no conventional ship. They had received no reply to their signals, and he realized they wouldn't. It was an iceberg, moving through the water apparently borne by the undercurrents at an incredible rate of speed. More and more of the icy intruders were making their way into the warmer waters. This one should have melted by now, but the undercurrent it was riding on must have moved it too rapidly from its northern mooring.

He gave orders for evasive action and the ship swung to port only to discover through her instruments that the mass was too big to get around. That damn berg must have been fifty miles long, and they could get neither to the left nor to the right of it. By the time the reactors had built up sufficient power to enable the *Leviathus* to outrun her pursuer, the berg caught up with the submarine.

With the possibility of a collision uppermost in his mind and in an effort to keep ahead of and get around the berg, Commander Llanwylf had given orders to run obliquely to it. The berg rammed the sub to starboard and bounced her away, then kept on, pushed by the current, unaware, unfeeling, oblivious to the damage it had just caused.

Llanwylf remembered sailing years ago, on ships that had not been equipped with sonar, and was grateful for one more modern invention. At least there had been a warning, time to rig for collision.

As the Damage Control crews began reporting back, it seemed there was little serious damage. Water was entering several rear starboard compartments, a result of the outer plates buckling, but they were quickly sealed off. As they were only for stowage, it seemed that *Leviathus* would be able to continue on course, repairs being effected without urgency.

Until his chief engineer pointed to his air gauges. The safety level of pure air was dropping — only a few hours of clean air left. Repair crews rushed to pump out the compartments, but there wasn't going to be enough time.

It would spoil their record, of course, but damn it all, their lives happened to be more important than what he wrote into the log. Llanwylf gave the order to surface.

"Captain, there's a craft drifting out there, with someone in it." The crewman pointed, and

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Llanwylf took the glasses to look. An unkempt, swarthy man with long black hair was leaning weakly against the side of the small, crude rowboat. The captain called for medics and for crewmen to gaff the boat.

They pulled it close, then went down into the water to help the man out. The touch of their helping hands on his raw, sunburned skin was agonizing, but somehow he knew they meant to help and tried to pull himself up.

The medics helped the stranger toward the hatch but it was impossible for him to walk. They slung a stretcher down — as they had tried to lift him, he cried out in pain — then took the stretcher to sickbay. There one of the medics put something against his arm that stung and he fell asleep directly, after wondering why they had done that.

Doctor Marwyl presented himself to the captain after the stranger had been tended to and informed him that the man had eaten and was now sleeping normally.

"Repairs will be finished shortly, Doctor, and we'll be submerging. What are we supposed to do with him?"

"He'll need rest for the next two or three days," replied Marwyl. "We're certainly not going to set him out in that boat."

"No," said Llanwylf, "but once we're back under, we're definitely not coming up until the scientists are finished. We've wasted enough time already. Besides, where are we supposed to let him out? I don't suppose you can understand him?"

"If we could, I doubt that he knows enough to point out on a chart where he comes from. But from the few words he's spoken, I've a feeling that our languages are similar."

"Well, doctor, he's your patient and your responsibility now. He'll have to stay with us, but keep him out of the way."

The stranger turned out to be one of the inhabitants of the Mid-Islands and more intelligent than supposed. The doctor and he were soon able to pick up enough of each other's language, as they *were* similar, a fact which caused Marwyl to wonder about their common ancestors.

Marwyl was on the bridge, in conversation with his captain. "Seems our friend discovered caviar. His people aren't allowed to row those little boats out too far. The deity they believe in apparently doesn't want them to, and they themselves are scared stiff of sea-monsters. Anyway, he went out farther than he's supposed to. He doesn't seem to have set much store in this god. And he had discovered what the

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insides of sturgeon taste like.

"Well, he went out past the others, and while he was basking in the sun a storm blew up. The rest is obvious. Except for the fact that the four days he spent out there seem to have convinced him that a supreme being probably does exist — especially since we came along and rescued him.

"You know besides this almost sophisticated viewpoint on religion, his people are living in towns now. They've been out of caves for enough generations for him to have no knowledge of that kind of life."

The land he had come from was dominated by a huge, flat-topped, bare stone cliff that rose up from the center of the peninsula. When he was shown topographic photo-maps he was easily able to point it out. Months later, when the expedition's studies were completed, the *Leviathus* made her way back toward the Mid-Islands.

His town was set on the inside of the elbow of land and the sub surfaced on the outer sea-edge of this shook, where they would not be seen. A small boat was put down, and he was rowed to shore.

"You know, he really was a likeable chap after we fixed him up," said Marwyl.

"Interesting what orthodontia can do for someone's appearance," said the captain, referring to the fact that they had repaired and cleaned his broken discolored teeth, then went on, "I think we've managed to learn enough about the growth of his people's civilization to send field crews out there soon."

The boat came back; Llanwylf made his way to the bridge to observe the waters engulfing his ship, and *Leviathus* submerged again to make her way back to Atlantis.

It took him the rest of the day to make his way along the beach and around the spit of land; he had grown soft from the months aboard the ship. When his people saw him come walking wearily toward the center of the town, they rejoiced.

"Our God has saved you," said the elders.

"Yes," he said simply, "yes, He has."

Where had he been, they wanted to know. And what had happened.

He told them of his four days adrift after the storm, and of the rescue by the enormous ship that had risen up out of the water; then he explained how the ship had traveled all these months back under the water.

A ship indeed, they said. It was quite impossible. They beg-

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ged him to be truthful. He spent a long time trying to convince them. He smiled, to show that his eroded and blackened teeth were now even white.

Our God has done this to welcome you back to Him, they said. He tried to describe the ship, scratching the long ellipse in the dust, telling them of the transparent bow and the lights that showed them their way underwater.

The elders conferred. "We have decided that you have been deluded in your shock. This giant ship must indeed have been a sea monster, probably a giant whale. But we shall give thanks in the morning for your deliverance."

"I know that our God did save me; but you cannot tell me that the ship was a whale. I *know* it was a ship," insisted the man they called Jonah.

—LISE BRAUN

★ ★ ★ ★ ★

FORECAST

As you'll see elsewhere in this issue, the man who carried away all the marbles in Galaxy's $1000 Award for the best story published in *Galaxy* or *If* for 1968 is Cliff Simak. Winning awards is no surprise to Mr. Simak; he's had them before (most recently a Hugo for *Way Station*, which appeared in *Galaxy* a few years ago as *Here Gather the Stars*) and, chances are, he'll have them again. He's been producing top-rated science fiction for about a third of a century now, and the end is far from in sight.

Next month, for instance, we have his newest novelette. It's called *Buckets of Diamonds*. Will you like it? Well, when was the last time you read a Simak story you didn't like?

In the same issue there's a hefty long novelette by another long-time favorite, James E. Gunn. Last month in *If* we published his *Trial by Fire*, a story of a future Earth where science has become the embodiment of evil, and true believers fear it as good churchmen once feared the devil. Next month in *Galaxy* he continues the same theme to its logical — but not obvious — conclusion, in *Witch Hunt*.

Robert Bloch will be with us with a story; Willy Ley and Algis Budrys will return with their usual informed brilliance. And there'll be more, but how much more we won't know until we see how the type sets . . . .

And one thing more. The issue after next we're starting a new serial. It's by Frank Herbert, and it's called *Dune Messiah*. It's recommended.

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The Weather On Welladay

by ANNE McCAFFREY

Illustrated by REESE

Welladay was a watery world, known through the galaxy for the violence of its weather — and of its inhabitants!

I

Welladay was indeed a watery world, Shahanna thought as the day side of the planet turned under her ship. Good thing that explorers were obstinate creatures or the hidden riches of this sopping, stormy world would have gone unnoticed.

She checked visually as the ship's computer began to print landing advice.

"I'm not that stupid," she mur-

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mured, appreciating the turbulence of several storm centers that blossomed in the northern hemisphere of Welladay. She tapped out "locate" for the Rib Reefs, the rocky spine of the planet which stretched from north to south and broadened at "shoulder" height into the Blade, the one permanent installation on the watery world. "At sunrise, hmm? Wouldn't you know? And right in the path of one storm. Well, let's beat it in," and she began to punch out landing coordinates.

At that moment, the proximity alarm rang. She hit the "enlarge" toggle of the screen control just in time to see the telltale blips — the small satellite that ought not to be in Welladan skies. Then her ship rocked with the violence of a direct hit. Shahanna stayed conscious long enough to press the arm-rest survival button, before she blacked out in a paroxysm of shock and fury and pain.

Odis planted his flippered foot on the whalelet's blunt snout and shoved.

"This is no time for nuzzling, nuisance," he roared, as the force of his thrust sent the baby backfinning. Whales like to be talked to — roared at — though there was small chance they understood more than the tone of voice. Some fishmen denied that much comprehension. "Almost through now, mother," Odis bellowed reassuringly at the massive creature whose thyroid glands he was tapping.

The dial on the long-beaked suction pump reached the red and, with more deftness than others gave him credit for, Odis broke the connection and sealed the beak. He closed the tap mouth and noted the date of this tap with paint-pen above the metal-insert. Old tap-dates had faded but the new paint would glow for the three months it took a mature whale to generate more vital radioactive iodine in its thyroid gland.

Odis touched the zoom button on the drone remote control, scrawling the whale's registry number on the beaker before he held it beside the luminous date for the drone to record. That formality observed, he scratched the female's rubbery upper lip where the scales were torn. What kind of a fight had she been in? Well, the wound was healed.

Again her child tried to nose Odis's fishboat out of the way. Chuckling over its antics, Odis climbed up the boat's ventral fin, over the back to the hatch. Ducking below, he stored the precious beak of radioactive iodine in the chemfoam-protected carrier.

Back on the fishboat's snub-nosed brow, Odis frowned at the sight of the school of whales be-

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ginning to melt away from the neighborhood. He'd been out since early morning, tracking them down. He'd spent on hour easing into the herd, before he had tried to tap one. He'd pounded affectionately on the snouts of the mammals he knew as well by scar marks as registration code. Two shied away from him so wildly that he had begun to worry if this group had already been milked by that fardling pirate. When he had finally got alongside the old blue-scarred cow and done a light top, he'd decided that their weather-sense was all that was making them skittish.

Between the freakish storms of Welladay, Odis growled to himself, squinting towards the darkening horizon, and fardling pirates, they might as well pull the plug on operations here. He frowned. Where else would he find a world more to his liking? A task more suited to him, a man born and bred on a high-gravity planet? Or, and Odis snorted, creatures big enough not to suffer from his inordinate strength.

He stepped on the release for the the outboard panel and began to beam towards Shoulder Blade for a weather report.

The Christmas-tree of instrumentation lit up with various local indications of the weather. But when he tried to reach Okker in his harbormaster's lookout at the Eye of the Lagoon, the beam crackled with interference. So the easterly storm had hit them. Even with a band of weather satellites, you couldn't always be sure of weather on Welladay.

Odis tagged the playback in case Okker had broadcast while he was tapping the whale. He whistled as he listened to Okker's sour report of mach-storm warnings, the advice that all vessels return to Shoulder at cruising depth and held at shelf-depth until recall: the local storm over Shoulder was only a squall.

The warning was repeated twice with additional ominous details on the mach-storm's wind velocity, estimated drift and duration.

Odis grunted. He could just imagine Okker's disgust at issuing such a message. Tallav, the maggoty Planetary Administrator, had probably been at Okker's elbow. With the exercise of tolerance, Odis could understand Tallav's ineffectuality. A meek man, not suited to a blustery, stormy world like Welladay, even if affairs proceeded normally. Now Tallav was caught in a fladding bind: someone was pirating the main source of Welladan wealth so that no substantial revenue had been garnered from the

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whales in months. Result: supplies could not be paid for; credit had been suspended; and with the depredations of both pirate and natural catastrophes, only three fishboats were operable. Requests from legitimate sources for the priceless radioactive iodine had accelerated to demands: Urgent! *Top Priority*. Gray phage was endemic and periodically epidemic; the only specific vaccine was a dilute suspension of the r.i. Short of tapping to death the few whales they could now find, Welladan fishmen were also constricted by lack of operable craft.

The two best fishmen, Odis and Murv, a newcomer on a Debt-Contract, had been sent out in an attempt to find and tap enough r.i. to pay for at least one critically needed cargo. Whatever Odis and Murv could get today was crucial. Odis wished they could charge a hardship premium but the price of r.i. had been fixed by Federation who evidently were too concerned with other galactically shattering crises to pay attention to repeated Welladan requests for investigation.

And here was timid Tallav, calling the fishmen back because there was a mach-storm brewing in the west. Odis ran a quick check of the christmas-tree instrumentation on the approaching storm, now boiling black and ochre on the horizon.

As he appraised the readings, he maneuvered his ship towards the nearest adult. He could get one more tap completed before he'd have to duck and run home. Fishboats were sturdily designed for Welladan waters, to race with the scaly spawn of her seas on hydrofoils, to plunge trenchward with the whales, to endure the savagery of a sudden squall, to wallow, whale-like, within the school itself and not be attacked by a nervous male.

He coasted along the port side of the mammal, rather pleased that the creature was not shying off like its schoolmates. The painted code above the tap-vent had faded completely. Odis toyed with the notion of perhaps a beak and a half of r.i. as he made his preparations to tap.

It was then that he noticed the bad color of the scales. At first he thought it was the light. The sky was already changing with the approach of the storm. As he looked around, there wasn't another whale in sight; they'd all raced away, north and south, to drive deep from the storm center. This whale wasn't moving because it was close to death.

Cursing with frustrated anger, Odis stomped below, retrieved the beak he had just drawn and prepared to pump it into the sick animal. Would it be enough? Was the gesture a waste of fluid

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now, as precious to the life of Welladay as to this mammal's? Odis refused to consider it a waste. In an angry scrawl he painted date and circumstance on the whale, underscoring the notation with a skull and crossbones as broad as he could make it.

He stepped back then, clenching his teeth against the brutal wastefulness of the pirate, wondering bitterly how many more of the now vanished beasts had been tapped dry: how many more corpses would roll, black and bloated, on the fresh tides after the storm?

He waited, hoping for some sign of change in the creature. There was no way of knowing how long ago the tap had occurred: hours, days? Or how swiftly the infusion would correct the deficiency.

The wind freshened now; the outboard panel chattered metallically, then began to crackle with an authoritative noise. A craft approaching? Odis scanned the clouds. Suddenly a second drone broke into view, higher and north of his. He glanced down at the sea-viewer, waiting for the indication that another fishboat approached. The drone whistled overhead and the seaviewer remained tale-less.

Murv was the only other fishman out! Where was he that he'd send his drone back alone? Had he been caught by mach-violence? A wilder shriek tore the air; the whale reacted with nervous bobbing, pulling away from the fishboat.

Odis swung the christmas-tree, got a fix on the sound and followed it, high up but lancing downward, downward, right into the mach-storm. He flipped the track toggle, keeping the outboard panel lined up with the visual trace of the intruder until the spaceship faded and disappeared into the clouds.

That boiling trail had come from nothing based on Welladay. And it was heading away from the only settlement on the water world. Odis retracted the outboard panel. As he clambered down the ladder, he shot a final look at the whale, now moving slowly in a northerly direction. No, the r.i. had not been a waste. If the creature could just make it out of the storm's path, feed himself up on plankton in the northern waters. . . .

Odis slammed the hatch down and reached the pilot's couch just as the computer printed out the intruder's course: straight into the storm, directly in line with the only other permanent landfall, Crown Lagoon. The realization was particularly bitter to Odis, for it was the direction

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from which Murv's drone had just come.

Slowly Odis tapped out a new course for the fishboat. Not back to the safety of Shoulder Blade, but straight into the storm, directly on the intruder's tail. Then he fed into the computer the details that Okker had transmitted on the mach-storm. As the printout chattered, Odis sank back into the padded couch, his suspicions confirmed.

In approximately five hours, the eve of the mach-storm would be centered over the gigantic old volcano whose drowned mouth formed a twenty-kilo-wide lagoon, the shards and lava plateaus of its slopes like a galactic-size crown, thrown down just above the equator of Welladay, in the shallow meadows of the western seas.

Murv could lie in the deep beyond the island's shores, safe enough even with a mach-storm lashing deep into the ocean, until the eye of the storm covered Crown. Murv could surface then, deliver the stolen r.i. to the ship which had sneaked in under cover of the storms. Well, Murv would do well to leave with that pirate.

Once the Investigator got here — perhaps before the planet was registered as Bankrupt and taken over by Federation — Welladay would be no place for any freedom-loving man. Flads! Murv must have enough r.i. on him to buy a planet. He sure had sold out Welladay!

Grimly Odis settled down for the long run. He'd stay on the surface and run on hydrofoil as long as he could until the storm's violence forced him to the relatively quieter, but slower depth. He had to intercept Murv before the traitor got the r.i. off planet.

But where had the man hidden the r.i. all this time? Every possible crevice on Shoulder Blade had been repeatedly searched once the fishman realized what was happening. And Tallav had initiated the drone escort to prevent any fishman from tapping too deeply. How the flads had Murv managed?

True, he'd sent his drone back, but you couldn't tap a whale in the midst of a storm and he was within rights. Indeed, Tallav would have screamed if Murv had kept the drone.

Odis leaned forward, tapped his own drone's controls. He printed out a message for it to transmit once the squall lifted over Shoulder Blade, then sent it to track him miles above the coming storm. He might just find it useful to have a drone in the eye. He'd risk Tallav's tantrums.

There was nothing more he could do now. Odis settled down to a short nap.

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II

The old survey charts had better be right about that underwater channel into the Lagoon, Murv thought, listening to the tortured stress of the fishboat and grimly watching the danger lights flick and blink warningly. The fathometer marked the unsteady ascent as the craft bucked tidal pulls and storm rips. He must be nearing the archipelago.

The straps that held Murv to the pilot's seat also cut into his flesh, and he cursed absently as he began to match the chart to sea-viewer.

Blighted planet! The whole thing had appeared so fardling simple. He was used to risks, trained to surmount them, so he'd opted contracting as a fishman, look around for a while, spot the trouble, and back again, ready for more demanding work. On a watery planet, with only one permanent settlement, only one product of value that was in the highest demand throughout the galaxy, what could have been simpler? He had not, however, counted on such a trivial detail as weather. Nor the mimsy-pimsy fardling of a Planetary Administrator thinking up a drone escort to prove *his* fishmen were not the murdering pirates. That had restricted Murv's investigations, and he could not lose this opportunity to search Crown. Not that it made him trust Tallav. Murv knew better than to trust anyone for any reason.

And Murv had not counted on sympathizing with the great whales. After he'd been taught to milk 'em, after he'd been assigned a school, it had annoyed the hell out of him to see the rotting carcasses of whales which had trustingly let humans tap 'em to death. Even lined up to get milked. No, the waste — the fladding waste of it galled Murv the most.

Ah, he must be nearing the tunnel mouth; he could feel the fishboat being sucked relentlessly towards the basaltic shelf. His fingers flew over the pitch and yaw controls, decreased the play in the helm and ignored the neck-jarring rolls. On fathometer and the roiled viewscreen in front of him, the bottom of the ocean met the ramparts of the old volcano in a solid wall of tortured lava.

Shahanna was roused by the shrieking hiss of the insistent wind. She opened her eyes to the grayness, to the realization that the crash foam was dissipating, to the knowledge that she was still alive and breathing. In spite of the cushioning foam and the padding of her seat, she felt

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thoroughly wrung out. Motion was painful. She turned her head, groaning as stiff muscles protested. A solitary yellow light gleamed on the control panel, then blinked wanly off as she watched. The ship had sent out its death-knell, the last thing this type of spacecraft was programmed to do before all its systems went dead.

Shahanna reached with an enfeebled hand to her side pouch, fumbled for a stimulant and a pain depressor. Clumsily she jabbed them into her arm and then, gasping at the discomfort even that slight motion caused, lay back. The drugs worked swiftly. She staggered to her feet, worked her muscles, relieved that nothing had broken or split about her. Her wrist chrono showed that some eight hours had elapsed since the unexpected attack on her. Automatically she reached towards the log recorder.

"All systems dead, gal," she reminded herself and looked out the plastight window.

Jagged black rock surrounded the nose of the scout.

"How lucky can a gal get? I cracked up on land?" Shahanna frowned. "Shoulder?" The Rib Reefs had been half a planet away when she'd been shot down. There was no possible entry she could have made that would land her on Shoulder. But there had been some other, semi-permanent land masses on the charts, if you could dignify a wayward archipelago or a transient volcano as land masses.

The lock was jammed solid, Shahanna discovered, but the escape hatch was clear. The little scout ship rocked under her feet, and she realized it had been rocking ever since she had roused. The pitch of the wind had risen a few notes too, and water sloshed across the viewpane in a constant fall. If she were on a portion of those archipelagos, she was on a very precarious one.

Shahanna wasted no further time in speculation. She quick-sealed her orders to her ribs, slapped additional supplies to her belt, shrugged into an all-purpose suit, harnessed on a life tank and headgear, grabbed the water-aids, punched the destruct on her ship's instrumentation and threw open the escape hatch. She got a face full of wave and drew back sputtering and choking, arranged her mask and took a second look.

Gaunt black fingers of stone held the ship but the rising tides, wind-lashed and moon-churned, rocked the boat in its impromptu dry-dock, grabbing with greedy urgency. What remained of the aft section of the ship was rocking slowly down into the water.

"That guy was a good shot. Cleared off my engine. But I'm

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a live one." Another wave slapped across her face. She ducked instinctively and then, with a deft movement, was over the side of the ship, its bulk protecting her from the worst.

She could see beyond, through the spaces of the finger rocks. It wasn't comforting, for the huge expanse of water was equally wild. A grinding sound reminded her that she had little time for deliberation. The ship slipped further down the rocky palm. Shahanna saluted it, promising retribution, and clambered up through the rock fingers. She did not see that an outcropping of rock caught and held the forward section of the sliding ship above the water.

This is the damnedest terrain, Shahanna thought as she scrambled higher, grateful for the tough fabric of her gloves a she found handholds on the razor-edged rock. The rain was coming down in such heavy torrent that she could barely see directly before her. The wind pounded her with hammer blow. She'd not last long in this, Shahanna decided, peering around for some sort of shelter against a rocky ledge. Doggedly she climbed, instinct directing her to such height as this unseen rockpile afforded. She climbed, hanging on during the vicious buffeting of water and wind, then inching upward, for what seemed an interminable time. The absence of water pouring over her, the slackening of the wind apprised her of sanctuary for she was inside the little cave before she realized it existed. With an inarticulate moan of thanksgiving, she crawled far enough inside to be out of the clutch of the elements. Sighing she rolled onto her back and exhaustion claimed her battered mind and body.

III

Planetary Administrator Tallav watched anxiously as the nets drew the battered space craft into the safety of the Shoulder Blade hangars. Almost on cue, rain in blinding sheets plummeted downward until the dome over the living quarters beyond the hangars became a waterfall and the storm drains filled with alarm-speed. Tallav shuddered at the ferocity of such floods.

You'd think twelve-foot-deep dikes would be ample anywhere — but not on Welladay, he thought, as he started down the ramp to welcome the long awaited Investigator.

It wouldn't do to appear nervous. Might cause suspicion. And he oughtn't to appear irritated that it had taken Federation such an unconsciously long time to dispatch an Investigator. Didn't they realize the consequences of

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letting this out-and-out piracy of the vital radioactive iodine go on for so long? Surely his messages had been explicit, the reports full. But to wait until the Central Credit actually suspended all shipments to Welladay — that was disgraceful. Disgraceful and unjust.

Tallav slid back the portal and stepped out into the rock-hewn chamber that housed drones and visitors' shuttles. Such noise as the crewmen made in securing the ship was lost in the vast room, but the net was now retracting and the port of the shuttle free.

Tallav was a little surprised at the Investigator's physical apperance. Oh, he didn't expect a full uniform for a minor planet like Welladay, but an Investigator ought to appear in something more than a faded, shiny one-piece shipsuit.

"I'm Tallav, Planetary Administrator, Grade 33-B," he said in a firm voice, saluting the new arrival with what he felt ought to be the proper deference. Investigators were not exactly equal in status to Planetary Administrators, but they had superplenary powers which they could invoke if circumstances warranted. "And you are Investigator — "

"Brack's the name."

Tallav was a little annoyed by the very casual return of his salute.

"Your arrival couldn't be more opportune," Tallav went on, indicating the exit to Brack. "We haven't so much as a drop of r.i., and two top priority emergency capsules came in just before you got here. The tone was rather highhanded. You timed that a mite close, if I may say so."

The investigator shot him an odd look as he ducked under the portal. Tallav dogged the lock wondering if the investigator thought he was being critical.

"Storms on Welladay are unusually violent," he continued. "That's why we net everything down."

Brack snorted and let Tallav lead the way to the office.

"If you'll just come this way, Investigator, my tapes and personnel are entirely at your disposal. We want this piracy stopper immediately. . . . "

"In that storm?"

"Well, no, of course not. I mean, that is . . . surely my communications gave you ample facts on which to draw some conclusions? After all, there aren't very many places on Wellady from which a pirate could operate."

"No, there aren't."

"Now, here we are. May I offer you some refreshment? Or would you permit yourself to try some off-world stimulant? I'm afraid the commissary is a little

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low . . . tedious, this business of being boycotted until these pirates are apprehended and the r.i. is collected properly."

"I could do with some hot protein. Natural . . . if you can supply it."

Tallav decided not to take offense at the suggestion that Welladay could not decently feed its population. He roused the messhall and ordered a meal from his private stores. No sooner had he turned, smiling, towards the Investigator, than the com unit peeped urgently.

His hand hovered over the unit to silence it. Then he saw it was Hangar calling. The dolts hadn't managed to damage the Investigator's ship?"

"Well, what is it?"

"Drone K-Star is back, P.A. Or rather, what's left of it is back," the hangarmaster reported.

"Who was that assigned to?"

"Murv."

"Are all the other drones back?" he asked, inadvertently glancing at the waterfall that covered his plas-glas wall.

"No sir!"

"*What?* Who could still be afloat in this?"

"Odis."

"Odis? But he . . . get off the line. I must talk to the harbormaster."

Angrily he jabbed the new call.

"Okker, has Murv got in yet?"

"No, nor Odis either. Just like that newworlder to try and send his drone back through a storm," old Okker growled.

"What were their destinations?"

"You ordered 'em out yourself. Told 'em to milk anything they could catch."

"Well, you knew a storm was coming up. Didn't you call them back?" It was difficult for Tallav to restrain his irritation with the old fool. No respect for status. And just because he'd been one of the original fishmen of Welladay, he thought he knew more about everything than a trained Planetary Administrator.

"What do you think, Tallav? I know my job as Harbormaster. Besides, Odis is smart enough to run submerged for the Eye and drift back with it till it disperses."

Tallav shuddered inwardly, trying hard not to notice the half-smile on the Investigator's lips at the impudence of his subordinate.

"And Murv?" Tallav was compelled to ask. He distrusted the newworlder and would like nothing better than for him to be their pirate. He looked the part and he was obviously opting off as soon as he could. That was the trouble with the Debt-Contractees: men forced to accept undesirable-world employment had no real interest in their work.

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"He's not back yet either."

"Well, why didn't you report their absence when the storm broke?"

"Did. You weren't in. Down meeting that snooper you sent for so long ago."

"Investigator Brack is present in my office."

"Good fer him," Okker replied, ignoring the frost in Tallav's voice. "Now let me get back to my Eye. That damned fool Sharkey's out, too."

Brack was suddenly very alert.

"The Chief?" Tallav was now fully alarmed first by Brack's reaction and second to the thought of losing Sharkey. The man was a sheer genius with the fishboats, able to repair absolute wrecks. If he lost the engineer, he might just as well resign. He'd never get a replacement at the price he could force Sharkey to take.

"You can't test a patched hull in dry dock, you know," Okker was reminding him needlessly.

"Yes, yes. Keep me posted."

"Don't I always?"

The connection was broken at the harbormaster's end, before Tallav had the chance. Fortunately the meal arrived as a diversion.

"And there's not a drop of the r.i. in store at the moment?" asked Brack as he attacked Tallav's bounty with more gusto than manners.

"Not a drop. In an attempt to fill these . . . these demands — " Tallav gestured towards the message capsule shells — "I sent out my two best fishmen."

"In that?"

There was no doubt of the Investigator's disapproval.

"No, not into that. That developed some hours after they had cleared port. Even with weather satellites keeping constant guard, turbulances can make up with frightening speed. You see, when there are two or more moons in conjunction, particularly with one of the other planetary masses in the system . . . "

"Agreed, agreed. I know my astrophysics. So that means that the only r.i. is either still in your whales or preferably riding out a storm."

"And hidden somewhere in the possession of these pirates."

"You have proof of piracy?"

"Proof? Of course. The rotting hulks of whales who have been deliberately, wantonly milked to death."

"No more than that?"

"What more is necessary?" Tallav was appalled at the man's obtuseness.

"You've got . . . how many fishmen?" The Investigator's smile was condescending.

"No Welladan fishman would

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milk a whale to death!" Tallav sat up stiffly in protest to such an allegation.

"You're sure?"

"Very sure. And just to prevent such ridiculous accusation being leveled against my subordinates, I took precautionary steps. You heard my hangarmaster report a drone's return? When it became apparent that someone was tapping the whales to death, I initiated a drone-escort for every fishboat. The drone is programmed to hover while tapping is in process, taking due note of quantity tapped from the glands, and the number of the mature whale. They all receive a tattoo, you see. There could be no escaping such vigilance."

The Investigator shrugged. "But didn't I understand that there are two ships out, and only one drone in? Murv, wasn't that the name? If there's no drone watching him right now. . . . "

"In this weather? It covers the entire northern hemisphere. You couldn't possibly tap in this weather. Besides, the whales have undoubtedly sounded for protection."

"Northern hemisphere, you said? What about down-south?"

"No whales in any great number. Shallow except for the Great Longitudinal Trench, and that's too deep for fishboats anyway."

"Who's this Sharkey?"

"Our Chief Engineer. Marvelous talent with any kind of engine or vehicle. Keeps our boats afloat and our drones aloft. In fact, he helped rig the control device so that the drone hovers the instant its linked fishboat stops.

"Sharkey, huh? Appropriate name for a water world."

"Beg pardon? Oh, yes, I see. Ha ha."

"*He*'s out without a drone."

"Oh, just checking a hull. You can't do that in dry dock, you know. And we've practically no more materials until Central Credit releases us long-overdue shipment. Besides, he may be a genius with an engine but he couldn't tap a whale to save his life even if the weather were calm enough to do so."

"How so?"

Tallav leaned back; these were questions he could answer. "Came here originally as a contractee. Whales didn't take to him. Couldn't even get near enough to them to do a tap. They got to be able to identify the pulse of his fishboat and scattered." Tallav didn't believe that himself but the other fishmen did swore that it happened.

"The whales didn't take to him?" Brack echoed Tallav's skepticism.

"Oh, they've as much rudimen-

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tary intelligence as other forms of mammalian sea life. They evidently developed affection . . . or dislike . . . of certain fishmen. Odis, for instance, and old Okker when he still tapped, and even Murv, the contractee, have no difficulty going deep into schools . . . until recently, that is."

"Very interesting." The Investigator squinted thoughtfully at the watery plas-glas. "I'm sure you won't mind if I take a walkabout."

"No, no," Tallav was on his feet too.

"On my own, Tallav. I'd like to talk to the Harbormaster. Take a look at the docks and quarters. You know."

Tallav did know and, while he disliked the notion that a Central Worlds Investigator would be . . . snooping — there was no other word for it — if such activity resulted in the apprehension of the pirates, he must suspend his scruples.

"And have you a counter?" Brack added, smiling slightly, his hand outstretched.

"Counter? Whatever for?" Tallav was shocked. The very implication that he, the Planetary Administrator, might not have conducted the most extensive search for any r.i. illegally hidden anywhere in Shoulder, that his estimation of the fishmen might be erroneous, that. . . . Fumbling from indignation, he turned his own handcounter over to Brack.

"And announce my presence," and Brack pointed towards the com-unit.

Rather stunned, Tallav depressed the "all-stations" switch and informed Shoulder Blade that Investigator Brack was to be given aid and assistance in his efforts to discover the pirates.

IV

The utter silence penetrated Shahanna's sleep. She lay a moment longer, aware first of the rough surface on which she was bedded, the closeness of the ragged walls. Other senses registered information: the freshness of the air combined with moist rock, the filtration of a curious yellow light and the assault of quiet on her ears.

She sat up, painfully aware of muscular discomfort and stiffness, as she crawled out of the shallow cave and looked around.

To the right and forward, massive clouds, black, gray, their their churning innards clearly visidle, scudded beyond the outer rim of the old volcano. All around now was the diffused vibrant yellow of cloud-strained light: brooding, somber yet bathing the surrounding area with an odd clarity that made this archipelago and its lagoon completely clear.

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Far off on the left, Shahanna discerned the approaching rim of the other half of this storm. She looked back at the receding section, trying to estimate the extent of the eye and how much she might have before the onslaught of the second half.

She shrugged. She had little option, and her shallow cave had sheltered her well enough.

Like a flagon, something bobbed up on the waters of the mirror-sleek lagoon below her. Instinctively Shahanna ducked down, then peered cautiously over the obscuring rock.

"The size of it," she gasped. The sealife of her home world boasted no such monster as this whale of Welladay.

Quickly she reviewed what she knew of the creatures. The fishmen of the planet milked their glands of the precious radioactive iodine by means of a surgical tap inserted into the gland-sac. Therefore, they were used to humans. So — could she not figure out how to activate the tap herself? Her hand went to her belt and then fell.

Even if she could tap the whale, how could she get the r.i. off-world with her ship a wreck on the bottom of the sea? However, at some time the fishmen must....

She stared at the floating monster, blinked as a piece of its head appeared to lift.

"A fish*boat*." And she watched as a man's figure was blackly outlined against the reflecting water.

She grabbed her hand weapon and dropped three shots forward of the fish-snout, waving her arms in a broad semaphore to attract the Welladan's attention.

To her amazement, he appeared to dive back into his ship. Within seconds the craft submerged.

Cursing her bad luck, wondering how else she could have attracted his attention, and annoyed at such a cowardly retreat, Shahanna began to pick her way down the basaltic rocks. She couldn't imagine that he'd brave the storm rather than face one lone occupant of the volcano. Surely he'd surface again.

Of all the rotten luck, Murv was growling to himself. The air in the fishboat was rank with human and machine stenches. He was weary and sore from the rough transit of the channel. The boat was leaking from half a dozen seams which he'd better seal before the second half of the storm hit him. Of course the lagoon would be quieter than the open sea but he'd thought to have the chance to air the boat as well as patch it while the Eye of the mach-storm passed Crown Lagoon.

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His sonar indicated an overhang along the south coast of the Lagoon. Good. He'd be undetectable there and could find out who that trigger-happy ape was. And if it just so happened that he was a pirate . . . stranded? Ho la!

Pirate? Jumping to conclusions? Flads, who else would be on Crown Lagoon in the middle of a storm? Tallav had only ordered two fishboats out and that figure was too rangy to be Odis!

Murv's irritation dissolved. He found himself eagerly scrambling into his gear. What luck! What sheer unadulterated luck! To find that passage into the Lagoon itself and to spot the pickup. Flads, where had the pirate hid his ship? Crown Lagoon was one fardling big place to hide in.

The unmistakable triple cracks of a handweapon had echoed around the Lagoon, unnaturally amplified by the volcanic rock hollows, the water and the curious flat calm of the storm's eye. The shots were distinctly audible to Odis, busy mooring his fishboat on the outer rim of the Crown. He tapped the outboard instrumentation button and the Christmas tree blossomed. Quickly Odis called the drone, down from its circling security above the stormy mass. If he could actually catch the pirates in the act of transferring the stolen r.i. . . . Even at speeds no human could tolerate, the distance was too great for the drone to get down in time. He slowed its descent. It wouldn't do for his eyes to be observed from the ground.

Three shots, he reflected. A signal? He glanced upward at the lowering yellow-clouded skies. There was plenty of time for them to make a transfer before the winds picked up again. And he had plenty of time to find that space-shuttle. There was more than one way to milk a whale!

He secured the outboard gear and went below for his suits and water aids. He snapped a drone remote control unit to his belt, a knife to his calf-sheath and a buckle-and-line sphere to his shoulder harness. He carefully checked the assist-tanks before he strapped them on and, jumping into the water, began to swim with rapid and powerful strokes around the southern edge of the outer Crown. There would be better plateaus for a space shuttle on the lower south edge of the island.

When she finally reached the shores of the lagoon, Shahanna kicked impotently at the coarse black sands. Nowhere was there any trace of the fishboat: nary wake nor ripple.

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"Slimy coward. Twice coward! What were you running from?"

She paused. Maybe Welladans were under attack from the same ship that had fired on her. Maybe that's why the repeated demands for r.i. had been ignored. Therefore the "coward" had only acted with sensible caution. Oh ho, that put a new light on the fisherman's retreat. And, if he thought she was one of the invaders, she'd never see him again, that was certain!

Disgusted, she sank down to the beach, leaning wearily against a convenient rock. She forced herself to rest, to drain off the poisons of fatigue caused by the difficult descent. Even if this planet had a lighter gravity than her own, it had been tiring.

Displacing enough water to inundate the narrow beach and half-drown Shahanna, a fishboat surfaced alarmingly close to shore. Choking from the unexpected drenching, the girl staggered to her feet, too furious to be frightened by the grotesque pseudofish eyes that glared at her from the boat's snout.

"That's the last, remember," a rough voice yelled at her. "And remember, if I'm not off this fardling world in five revolutions, I set the investigators on you when they get here. And they're coming."

Shahanna jumped back as a large plas-foamed cube landed heavily at her feet.

"Wait," she cried for the fish-snout was turning from her.

"Can't wait, you fool. And neither can you if you want to get off this fardling planet before the storm socks us in again. Grab that stuff and get off-world."

Shahanna watched as the hatch slammed down and water foamed over the fins of the fishboat. She looked back at the plas-foamed cube, its shock webbing black triangles against the gray stuff. It was the kind of protection given space shipments of valuable . . .

She dropped to her knees, her arms involuntarily starting to grab up the cube. My God! She pulled back. It had to be . . . *a cube-full of radioactive iodine!* Liters of it, just thrown at her feet. She threw back her head and laughed, the laughter catching suddenly in her throat as a sob.

"Well, you got what you came for, certainly. They got to give you marks for that," she told herself.

She rose to her feet, absently brushing the clinging dark sands from her legs. Her ship had sent out the death-knell. That would eventually connect with a civilized agency which would be compelled to report it to the authorities and a search would be inaugurated. She had supplies in her belt for several weeks, in addi-

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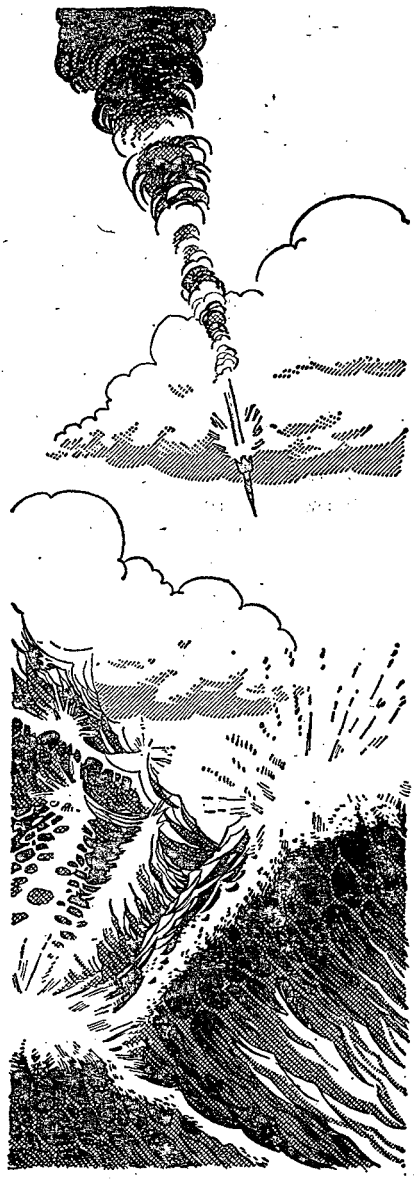
tion to what the sea could provide. Perhaps, and her chuckle was pure amusement now, she had only five revolutions to wait, until the misdelivery was discovered.

She felt much better suddenly. With a deft twist, she yanked the heavy cube to her back and began to retrace her steps to the shallow cave. That would be a difficult hole to find, and she'd be safe from the storm.

The ascent was slower and far more treacherous for the cube was not only heavy, but awkward. An unbalancing burden: its weight a strain even on her heavy-world strength. Shahanna had been chosen for this venture for many considerations, not the least of which was her known tenacity of purpose. She climbed upwards.

V

Murv watched the delivery with a mixture of satisfaction and irritation; he was too far away to make out the features of either party, or the cold letters of the fishboat fins. Murv took careful note of the odd gait of the receiver, definitely an off-worlder, someone used to a heavier gravitational pull. Murv knew to a kilogram the weight of those r.i. cubes, yet the off-worlder had shouldered it with ease.



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Muscles or not, Murv decided, that was going to be a fardling hard climb. The pirate must have ducked into the Lagoon at the onset of the storm, probably in a small shuttle craft. Must be a fladding good pilot, too, Murv grudgingly admitted, to land on a stormy Welladan sea, ride out a mach-storm and then trip along like that. Murv glanced over his shoulder towards the west. The black and ochre clouds were still low on the horizon but coming in fast. He grinned to himself. He *could,* of course, shoot the pirate now, take the r.i. back to Shoulder, and get off this fardling world for good, all legally and above-board, no need to blow his cover. But this did not solve the second part of the puzzle: who was the illegal tapper.

So a dead pirate informed on no one. And tackling an offworlder presented other problems, even to a man adept at rough fighting from combats on a dozen outer planets. Well, there was more than one way to milk a whale; Murv started obliquely after the pirate.

Flads! Why hadn't the fishboat swung just slightly to port or starboard so he could get at least one letter of the code? And why had not the fishman emerged further from the hatch? Murv could have identified him with one clear glimpse of profile. Murv cursed again, remembering that the only other man out when the storm broke was Odis. Murv was cynic enough to believe any man capable of any deed, given the proper circumstances of pressure and opportunity — but Odis? Whose love for the great whales was exceeded only by his love of this drenched world? He was the last man Murv would have suspected of treachery. Still, you never knew what went on inside a man's head. Everyone had a price.

That settled it for Murv. He could not kill the outworlder until he discovered the identity of both traitor and pirate — and learned, to his own satisfaction, why Odis tapped whales to death.

To Shahanna, time was shortened to the span involved in a one-time simple physical effort. One foot must lift, its toes finding a hold, somehow, on the treacherous rock. The toes must then grip, somehow, long enough to tense the calf muscles which must inform the long thigh muscles of the effort then required of them, to pull her torso after thigh, calf and toe. Arms must, somehow, manage to retain a grip on the shock-webbing of the, somehow, unquestionably valuable and exhaustingly heavy cube.

She was only vaguely aware of other timely pressures: the wind beginning to rise, gustily

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plucking at the overbalancing burden on her back now and then, or lightly cooling the sweat that trickled down her face and into her suit. The value of the light around her was changing, darkening as the other side of the storm neared the island. She was completely aware of being under observation, or that her tenacity indicated far greater familiarity with the terrain then she possessed. A sense of direction was another of her assets and once she had been to any place on any world, she was able to retrace her steps to it, as she did now, to the anonymous cairn amid hundreds of others, nearly like it, near to it.

She dragged herself and her burden into the cave and then, with a sigh of utter fatigue, curled around the cube, one hand seemingly welded to the shock web. The protective reflex as well as the darkening skies prevented Murv, when he realized that she was no longer climbing ahead of him, from discovering her.

He had followed cautiously, therefore slowly, and was not unduly alarmed when he didn't see the straining figure with its awkward load.

At first, he wondered how the pirate could have got so far ahead of him, until he reached the highest ridge of the southern escarpment and realized that the pirate must have taken cover. From here, the island jutted outward and downward.

It was then that he caught sight of the half-submerged craft.

"Fladding stupid fool. He is not going anywhere," Murv laughed maliciously. "But where is he now?"

Carefully Murv worked over to the ship, using the tumbled rockscape to cover his advance, keeping close watch on the open hatch lest the pirate discover him prematurely. He agilely reached the open lock, listening for any sounds of activity within. It was not a large shuttle, a single cabin job. He glanced in carefully, taking in the deserted ship in one sweeping look.

So, the guy hadn't made it back. He'd gone aground somewhere up in the crags. Murv began to pick his way up again, following much the same original route that Shahanna had. He was unaware that he was being observed, for his back was to the sea.

Odin had allowed the tides to pull him back under the water, deep enough so that his progress could not be seen. He surfaced again, twice, in fact, looking for an exit up the rock face so that he could outflank Murv. He was annoyed that it was Murv up there on the rocks. Annoyed but puzzled. Murv gave every ap-

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pearance of a man hiding: why should he hide if he were the pirate's contact? And where was the r.i.? Where, too, was Murv's fishboat? Odis debated the risk, glancing up at the clouds cudding and boiling on the horizon. He had kept the drone just above the cloud cover, now he directed it down, to the northern part of the island, for a skimming run designed to detect Murv's craft. The wind was rising enough to cover the whistling sound a drone made. Odis flipped on the visor and blinked at the rushing ocean pictured on the tiny screen. He sent it twice over the northern arc of the island, spotting his own boat moored on the east but no trace of another fishboat, either visually or sonically. He sent the drone aloft, remembering to check the wind velocity to be sure the drone was at a safe altitude. He sat down to think.

No ship. Had Murv lost his fishboat in the storm? Murv had a tendency to be too quick; he wasn't all that accustomed to Welladan weather and storm, he might have inadequately moored and the ship was sunk below drone sonar depth. Of course, Murv might have discovered a ledge and moored the boat under that. One thing was certain, the pirate was going no place. But who had blown off the afterstation of the pirate's vessel? Had the Investigator arrived, spotted the pirate ship and blasted it? If so, the Investigator must surely be at Shoulder now, and all Odis need do was wait till the storm lifted enough to get a message back to Shoulder. He settled down to wait, a weather eye on the approaching storm front. He had no intention of cutting it too fine back to the safety of his own boat. But Murv would have farther to go.

And why was Murv hiding? Had those three space shots been punitive rather than identifying?

The wind began to keen, its fresh gusts rain-laden in the darkening sky. Gouts of lightning spat through the bilious clouds. Warm air masses moving in, Odis thought with approval. Storm is breaking up a little. Weather was capricious; a real mach-storm like this one, despite the pull of two moons and the conjunction of another planetary mass, could break up with rare speed with a crustal shift up north.

Murv was moving, not merely shifting position but moving forward, darting to cover as he worked his way back up the slope. The rising wind was bothering him, Odis decided and followed obliquely.

A flash of a head-beam and Odis saw that Murv was definitely searching among the hollows

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and crevices of the cliff. Odis climbed faster.

He was in time to hear raised vices, echoing in an argument; but the sounds were so diffuse he could not pinpoint the direction.

The rising wind added its diversion. Odis cursed softly under his breath as he jumped from crag to block, flashing his own beam in and out the darker hollows, trying to scan around to prevent Murv from slipping away unnoticed.

The next thing he knew, Murv had emerged from a low ledge, his arms wrapped around the foam-cask. There was no chance for Murv to reach his handweapon.

With distinct pleasure, Odis stunned him with a full charge, neatly catching the cube as Murv folded.

Keeping one hand on the cube, Odis knelt, flashing his beam into the cavern. He caught sight of the darker lump of the prostrate body. He turned it over and was reassured by a groan.

Rain began to spray across his back as he crouched between the two unconscious forms. He could just leave them here; they'd both be out for a while. No. He didn't know where Murv's boat was, and he couldn't permit the man to escape. ReRsigned, he settled down to wait.

VI

"I don't know what you expected to find here," Okker said, his seamed face flushed with anger, "but are you satisfied now?"

"I really don't understand, Investigator," Tallav put in with understandable anxiety as he picked his way across the debris. "You certainly cannot have suspected Okker here, and he is absolutely the only one permitted in the Eye."

Brack was sweating from his exertions. He had pulled out every drawer, shelf and movable fixture in the rock chamber, rapped on every inch of the rock walls, trying to find a hollow; he'd geigered everything without a crackle for his pains. He didn't mind alienating Tallav or the ancient but he was furious over the fruitlessness of his search. He glanced at the two men, somehow now allied against him. That wouldn't do.

"This is the only installation known as the Eye on Welladay, isn't it?" he demanded curtly.

"What's left of it," Okker replied.

"Unavoidable. I . . . I intercepted a message, obviously from the pirates, setting up a contact point. I caught only part of it due to the storm's interference. 'Southern edge of the lagoon

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where the eye is centered.'"

Brack pointed to the lagoon harbor which the single big window of the Harbormaster's control room overlooked.

"Your control room is on the southern edge of the lagoon. This place is called the Eye. What other eyes are there on this fladding planet?"

Okker regarded him with a deep scowl, then slapping his thigh, burst out into a cackle.

"You sure you heard 'where,' and not 'when?'" He pointed a derisive finger at the investigator as he danced about in an excess of amusement.

"You fladding idiot, stop that!"

"I believe I can answer you, Investigator," Tallav said, his manner stiff as he waved Okker to be silent. "Logical topical references are deceiving to the newcomer." He smiled condescendingly on the Investigator. "This is not the only lagoon on Welladay. It is therefore possible that the message, which you say you heard imperfectly due to faulty transmission, said 'when,' not 'where.' With a temporal conjunction, I presume the contact point meant the southern edge of the Crown Lagoon, when the eye of the storm was centered on it. Really, most ingenious. With proper timing, the pirate could make contact, pick up the radioactive iodine and be off without

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being detected through the storm."

Brack swung around towards the exit. "Let's go then!"

"To Crown?" cackled Okker, reinfected with ill-timed amusement. "Not now. Eye's over Crown right now so they've made contact and the r.i. is off world. You blew it, Investigator!"

Brack seemed about to explode but Okker didn't budge. Then, with a massive effort, he controlled himself and began to smile ominously.

"No, that's where you're wrong, Okker. There can have been no contact because I disabled a small spaceship just after I picked up the message. Got a direct hit and saw it tumbling out of control. That r.i. is still on this world, waiting to be picked up. And I intend to do just that!"

"Not till the storm has cleared Crown, you aren't. Drones can't handle that kind of turbulence. not unless they go above it, and that'd be too high for non-pressurized cabins," Okker told him.

"I hadn't planned to use local transport," Brack's smile broadened.

"Couldn't. Ain't even a fishboat left with sound seams. And —" Okker pointed a knobby finger at the Investigator — "you just forget trying to make it in your space craft between now and when the rest of the storm hits Crown. Couldn't do it on the trajectory you'd need."

"If only Sharkey were back with the boat he was testing," Tallav muttered, "that could stand the trip. We have to get that r.i." Tallav turned to Okker. "Hasn't that squall lifted along the coast enough for us to find Sharkey? Where could he be?"

Okker shrugged. "That squall came up sudden. He probably had the good sense to hit for the open sea to avoid getting smashed. He doesn't like to go seaward, though," he contradicted himself, "but it won't hurt to look for him before the whales do."

"Before the whales do?" Brack queried.

"Like I said, the whales don't like Sharkey. I'll get a weather picture. We're clear enough to receive . . ."

A bleep severed the rest of his sentence.

"Odis to Eye, Odis to Eye: Drone-relay transmission. Proceeding Crown Lagoon at 1930 hours. Checking out spacecraft trajectory plotted towards Crown." A second raucous bleep.

"Of all the nerve," gasped Tallav, the first to recover.

"Must be that ship you shot up," Okker said to Brack with more respect.

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"He ought not to take such risks," Tallav muttered.

"Then he would be at Crown by now?" asked Brack in a tight voice, glancing up at the main chrono.

"Contact that drone, Okker," Tallav ordered. "Maybe we can relay a message to Odis to search for the r.i."

"Not if the eye's passed Crown," Okker grumbled but his gnarled fingers sped with unexpected agility across the communications board. "Crown's a mighty good place to hide something on . . . full of hollows, caverns and boulders."

"Get him to search the southern edge," Brack snapped.

"Yeah, that's right, isn't it," Okker said, glancing sideways at the Investigator.

Another unit began to chatter and a sheet of relay paper began to extrude from a slot.

"Weather relay from a satellite," Okker said and grabbed the print before Tallav or Brack could. "Hmmm. Weather's closed in again over Crown, but see here." His stubby forefinger followed the wispy leading edge of the machstorm. "It's breaking up." He moved his finger to the cloud formations on the right. "And we got some of the bonuses. You want to find Sharkey, you'd better git. I'll transmit to Odis's drone. His weather looks like it'll clear 'nother couple of hours and he can look for the r.i. Can't do moer'n that now."

"Be sure to tell him to search diligently for the r.i.," Tallav was saying as Brack urged him out.

Another alert blasted, and Tallav hesitated, his eyes widening at the distinctive sound.

"C'mon," Brack snapped.

"A sublight message?" Tallav moved back into the eye. "Now what?"

"Come!" Brack insisted.

"This is Federation Cruiser DLT-85F, based Mirfak. A death knell has been received from your planet, Welladay. Coordinates Frame BE-27/186. Search and recover. Search and recover. D-k assigned to Mercy Ship Seginus X. Advise."

"That pirate ship you shot down was a mercyboat. And it is on Crown Lagoon," Okker snapped in a hard voice.

Tallav turned slowly to Brack, his face pale and shocked.

"Your pirates are more ingenious than we've given them credit. Using mercy boat as a contact vessel. Very clever. We must outsmart them. Catch them redhanded. Let's go, Tallav!"

And Brack pulled the stunned Planetary Administrator down the corridor. Okker stared after them, his face bleak, his eyes thoughtful. He turned back to his board, then, and began to broad-

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cast a message for Odis's drone to transmit. Then he warmed up the sublight generator. If he was right, Tallav wouldn't scream at the power use. And if he wasn't — let him scream.

"I'm glad it wasn't you, Murv," Odis shouted, trying to make himself heard above the storm.

Murv nodded, grinning at Shahanna, who was unselfconsciously taping her orders back to her bare ribs. A bit heavy-boned, Murv thought, but no more flesh on them than was needed to make her a soft handful.

"Who is it?"

Even with Odis's lips tickling his ear, Murv could barely hear above the keening wind. He shrugged, then put his mouth to Odis's ear. "Someone steal a fishboat, sneak out under cover of the squall at Shoulder? He had to repeat it twice before Odis caught all the sentence.

"Not past Okker. Only two boats seaworthy, anyhow. No parts!"

"Okker might be in it!"

Odis stared at Murv for a long moment, then shook his head vehemently, denying that possibility. So Murv shrugged and patted the cube of r.i. significantly. Odis grinned.

Shahanna prodded Murv's possessive hand and jerked her thumb backward towards herself, rubbing the place where her orders for a top-priority requisitioned from Federation for r.i. were taped. She emphatically pantomimed the quantity of r.i. needed. Odis continued to nod and patted her hand reassuringly. She glared at Murv who just grinned back with sheer deviltry in his eyes. When she realized he wouldn't give her the satisfaction of acknowledgment, she reached across and gripped Odis firmly on the shoulder in an ostentatious gesture of friendliness. She almost wished Murv had been the pirate, instead of the agent. She wondered if the i.d. plate, uncounterfeitable evidence of his authenticity, ever ached the arm-bore in which it had been implanted. He didn't have to wallop her so hard when he snatched the r.i. Well, she mused, he had acted within the scope of the information he possessed at that time. Just as Odis had when he knocked Murv out. She was sorry, though, she couldn't describe the fishman who had thrown the cube at her feet. She'd had the most fleeting impression of him but she was sure she'd recognize him. However, that time was long off, judging by the siren winds. Shahanna assembled herself into as comfortable a position as she could and closed her eyes, to pick up her rest where Murv's entry had interrupted it.

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VII

"There's something over to starboard," Brack said, raising his eyes from the screen to squint through the plasglas snout bubble of the drone.

Tallav flipped up the call switch. "Must be Odis. We're halfway to Crown. Tallav calling fishboat. Tallav here. Fishboat. Answer."

"P.A.? You're in the ship?" Surprise and relief colored the voices of the respondent.

"Sharkey? What are you doing midocean?"

"Between the storms and the whales, I'm lucky to be anywhere!" the man snapped. "You don't see them on your screen, do you?"

"We've spent hours scanning the coast for you," Tallav interrupted, angry with relief at finding his mechanical genius. "You've the only seaworthy boat and the Inversigator and I — "

"Investigator?" Sharkey's voice was sharp.

Brack elbowed Tallav back from the speaker.

"Brack here. I have reason to believe that the pirated r.i. is still on this Crown Lagoon the P.A. has been telling me about. I intercepted a message arranging a contact point on the southern shore of a lagoon, only reception was faulty and I missed the entire message. Do you read me?"

"Yeah, I read you, Investigator Brack."

"Good. Now, can that fishboat of yours make it back to Crown Lagoon? You realize, of course, that we must pick up the r.i. before the pirate can retrieve it. Another fishman, named Odis, is presently believed to be in the vicinity of the Lagoon."

"Odis, but. . . ."

"Can your fishboat accompany us?"

"Yeah, if you can keep those fardling whales off my back."

"We cannot permit that r.i. to fall into the wrong hands, now can we?" Brack cut across Sharkey's complaints, more threatening than suggesting, Tallav thought.

"No, we can't," Sharkey agreed flatly.

"Good man. Now, how fast can that fishboat go?"

"Long as those squalls don't hit us, as fast as that airbubble you are in." And, as they watched, they could see the fishboat rise slightly from the water on its hydrofoils, and take off in a plume of sprayed water that arrowed northeast by east.

Before Brack could speak, Tallav banked the drone and poured on power to follow.

"Would they send another Investigator?" Odis ask-

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ed Murv, when Okker's held-transmission from the drone was completed.

Murv shrugged, grimacing. "It's possible. This has taken a lot longer than predicted. And, with the credit embargo and no ships touching down at Shoulder, I haven't been able to send in a report. They might think I'd been drowned here. Now, with Shahanna to identify the Welladan contact, we can finish it up in no time. First we've got to get this safely to Shoulder." He patted the r.i. cube.

"The traitor is Sharkey," Odis said gloomily.

Murv laughed. "I'm not sure of anything. Remember, I thought it was you and you thought it was me, and we both suspected Shahanna of being the pirate."

"Yes, but your Okker said Sharkey was still missing," Shahanna reminded the men, "and when he'd last heard from the P.A., they'd given him up for lost and were heading here."

"Try Okker again, direct, Odis," Murv urged, glancing up at the clearing skies.

"Another squall between here and Shoulder," Odis reported after several minutes of fruitless calling.

"This planet's fardling weather is . . . is . . . ." Murv broke off.

"Don't mind me," Shahanna suggested with a grin, "but ought we not leave here while we have a chance?" she added, pointing to the fringe of dark clouds on the western horizon.

"Okay. I'll check my boat," Murv said.

"I'll wrastle this down the hill again," Shahanna volunteered sighing deeply.

"I'll see if there's anything left of my ship, but I doubt it," Odis said with sincere resignation, starting south down the rocks.

"I can give you a hand part of the way," Murv offered, grinning at Shahanna.

"If you think you can keep up with me," she grinned back.

"Sharkey! The cube's on the rocks on the lagoon shore. Just where the contact said it would be!" Brack roared through the speaker.

"Oh, oh," Tallav gasped feebly. "However did it survive the storm, unprotected like that!"

"You're seeing things, Brack!" Sharkey roared back. "You're seeing things, I tell you."

"Like your whales, I'm seeing things, you fladding fool. It's clearly visible. Are you through that passage yet?"

"How'n hell could I be beaming to you if I weren't? I'm surfacing!"

"We're landing," Brack countered, warningly.

"I'm not sure I can land on

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that," Tallav squeaked, unable to see any likely surface on the tumbled rockscape.

"You'd better. I don't think I altogether trust this chief engineer of yours," Brack ground out between clenched teeth, his eyes never leaving the cube, white against the black lava on which it so temptingly sat. "In fact, I find it definitely suspicious that he knew such a convenient channel into this Lagoon which you, as planetary administrator, didn't know existed."

"Yes, but . . . how could he possibly . . . I mean . . . "

"There's a flat space big enough for this thing."

"It'd really be so much easier for Sharkey. And after all — "

"*Land.*"

"Good heavens, he's here already," Tallav exclaimed as he set the drone down on the flat-topped slab scarcely larger than the drone's landing feet.

"What do you mean?" Brack followed Tallav's gesticulations and saw the figure emerging from the water, heading towards the cube. "How'dya get out of this thing?" he demanded, fumbling with his tunic.

Tallav reached across him and flipped up the hatch release. Brack, his eyes on the figure, suddenly froze.

"That's not Sharkey!"

Tallav looked. "No, it isn't,, is

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it? But who . . . And . . . " Tallav broke off, staring at the Investigator. "How would you know what Sharkey looks like?"

"Get out, Tallav," Brack ordered and turned the handweapon on the startled man.

As the two men emerged from the drone, the figure on the shore had reached for the cube and grabbed it up, starting off, up the slopes with more speed than either observer thought possible.

"Halt!" Brack shouted and lobbed off a shot after the fleeing figure.

A fishboat broke surface, its hatch flipping open for the flying exit of a man. He also began to shoot, three short cracks splitting rocks just ahead of the fugitive. The man turned and began to descend as fast as he had climbed, now in the direction of the fishboat, obliquely away from the men by the drone.

"You see," Brack shouted at Tallav, "there's the pirate! We must intercept."

Tallav's previous doubts were swept aside by the urgency in Brack's voice, and he didn't hesitate to follow the man down the tortuous escarpment to the beach. Brack paused to whip a few shots to slow the pirate, but he was closing the distance to the fishboat faster than they could jump down the rocks.

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"Be careful of the r.i.," jabbered Tallav as the pirate used it as a shield.

The man flung the cube into the water and dove after it, pushing it ahead of him towards the fishboat, urged on by Sharkey who was running down the ventral fin to assist.

But, as Shahanna, winded and half-blinded with watery eyes, grabbed the shock-webbing for a final heave to the waiting man she got her first look at his face.

"You're not Murv. You're . . .," and she grabbed the cube back, frantically kicking out and away from the fishboat.

"Give me that or I'll blow you out of the water," Sharkey snarled.

"Shoot and you'll hit the r.i."

Shots whistled over Shahanna's head, and Sharkey backed behind the flaring dorsal fin. Shahanna heaved away from the fishboat to tread water halfway between both contenders, using the buoyant cube as a head shield.

"I'm Tallav, Planetary Administrator of Welladay," the shorter of the two men on the shore yelled at her. "Come ashore. If you turn yourself in, I promise you immunity."

Shahanna felt intense relief. They'd probably mistaken her for the pirate that's why they'd shot at her. She struck out to the beach.

Tallav jumped about in the shallows, splashing water in her face as he vacillated between grabbing the r.i. and her hand until she shook him off.

"I'm not a pirate. I'm from Seginus. My ship . . . . "

"You survived?" gasped Tallav. "We got the d-k relayed from Fleet."

"Your pirate shot my engine away," Shahanna began as Brack joined them, lobbing another shot at Sharkey trapped behind the dorsal fin of the bobbing fishboat.

"Investigator Brack mistook you for a pirate," Tallav explained nervously, "Why didn't you identify?"

"I never had the chance," Shahanna protested. "I was checking coordinates . . . ." she trailed off at the look on Tallav's face. She whirled to see that Brack's weapon was trained on them.

"I'll take that r.i., now," Brack said, smiling slightly. He grabbed it by the shock webbing, carefully stepping backwards, up the rocks, his gun pointed midway between Shahanna and Tallav, and Sharkey.

VIII

Several things happened at once: whoshing sounds and enormous splashings from the Lagoon and a whining whistle above. Shahanna launched herself to-

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wards the rocks, her body using every bit of advantage from muscles trained on a heavier-gravity planet as she leaped towards Brack. He could not keep track of three attacks at once, and his shots went wild. Shahanna ripped the r.i. from his hand, rolling sideways and down, ripping her suit against the jagged rocks, but managing to scramble away with the cube.

When she came to rest against a huge black fist of a rock, she dazedly saw Sharkey running up the spine of his fishboat, towards the hatch. She heard the despairing scream as she watched half a dozen fishboats close in on him. He was tumbled into the water to be ground against the converging hulls. A bolt lanced past her ear and she wrenched around, trying to put the rockfist between her and Brack. Somewhere Tallav was shrieking.

"They've got him. They got him. He's getting away. Stop him!"

Abruptly the sounds of struggle, aquatic and missile, ended and Tallav's exhortations ceased.

Battered and shaking with pain, Shahanna raised herself up. There was Brack, flung across the rocks just below the drone. Odis was climbing down, hand over hand on the line which Shahanna could see had tangled Brack's feet and brought him down. In the Lagoon its roiled waters lapping around Tallav's knees, only two fishboats remained: one, unbelievably, lay sideways on the rocks, its belly barnacle-covered, burping bubbles that glistened in the sun. The second fishboat was cruising slowly in to shore.

With a sigh, Shahanna sagged down and laid her scratched cheek against the cool cube.

"I really don't credit what I saw," Tallav insisted as he watched Murv and Odis bandage the Seginan girl. "Those whales . . . just mobbed him."

"Then how could he get close enough to a whale to tap 'em?" Murv asked with understandable exasperation.

"I think I know," Odis said after a long reflective pause. "Okker claims the whales got to know the sound of Sharkey's fishboat engine when he was still a fishman. When he couldn't get a reasonable quota of r.i., he got grounded. With no money, he'd no hope of lifting from Welladay so he took over maintenance."

"Best mechanic we ever had," Tallav sighed, worrying already about the wage he'd have to pay for a new one.

"Yes, he was a crack mechanic all right," Odis agreed. "Any fishboat Sharkey overhauled was as good as new. And he tested them himself!"

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"Of course!" Murv exclaimed, "and every time he tested a boat, he could move in on a whale which wouldn't recognize that engine. No wonder we had such trouble getting any school to trust us."

Odis nodded slowly.

"He's been the blackmarket source of r.i. for a long time, then," Murv went on. "Federation had been aware of a small supply trickling out long before you lodged a piracy complaint."

"Then Sharkey got greedy," Odis murmured, looking over at the stranded fishboat.

"But how could he have hidden such a quantity as this?" Tallav demanded, pointing at the big cube.

"You searched with a counter, Tallav, even in the maintenance dock. That's where we keep those shipping cubes, so Sharkey's hiding place would have registered chatter anyhow. And then, your pet mechanic was always working so hard to keep us afloat, long hours servicing boats, giving them test runs in all kinds of weather to be sure they were storm-proof . . . " Murv's mocking tone trailed off.

"Speaking of storms," Odis said, gesturing skyward.

"This fardling planet and its fladding storms!" Murv growled.

"I've got to get the r.i. to Seginus," Shahanna said in a soft urgent voice struggling to rise.

"We will," Murv grinned at her, "soon as we fix you up at Shoulder."

"But my ship's. . . ." and she looked up the rockscape significantly.

"Brack won't be requiring the ship he came in," Murv reminded her.

"Now wait a minute, Murv," Tallav ordered peevishly.

"Now wait a minute, Tallav," Murv mocked him, "Brack blew up her *mercy* ship," and he stressed the word pointedly, "and considering her invaluable assistance today, it's the least Welladay can do."

"Oh yes, well, in that case," Tallav subsided.

"Now, you take the r.i. back to Shoulder Blade in your drone, I'll take Shahanna in Odis's and. . . . "

I'm left with your fishboat?" Odis asked, slightly amused.

"My friend, kindly remember that's the one shipshape fishboat left on this wet and watery world. And we all know who's the best fishman on Welladay!"

Odis threw back his head and laughed.

"Yes, indeed, Odis, you be careful with it," Tallav added, frowning worriedly.

By the time Odis had clambered onto the fishboat, the two drones had taken off and were

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circling above him. He tapped on the outboard panel release and plotted a course across the wide Lagoon. The drones waggled a farewell as they whistled over him. Odis responded briefly and then began to read the christmas tree's gauges. A man had to keep an eye on the weather on Wella-day.

—ANNE MC CAFFREY

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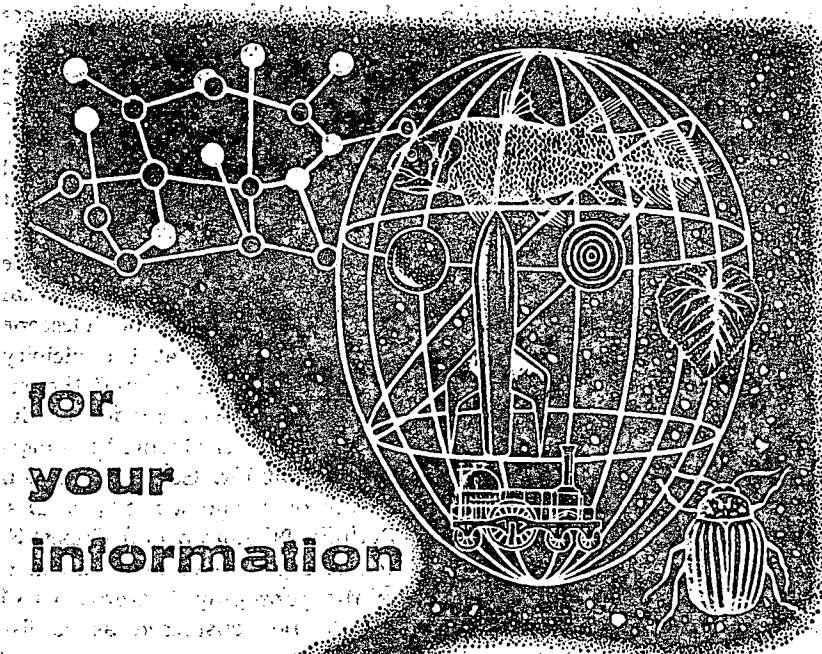

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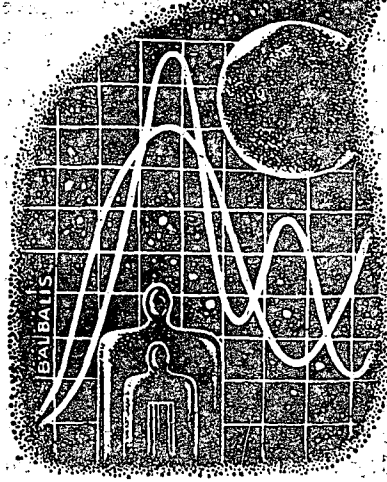

COLLISION COURSE

In June of last year, you'll remember, there was a great howl in certain quarters about Icarus. The Icarus in question was not the mythological character, but Minor Planet #1566. In Alabama, Georgia and California there were special prayer meetings asking for the safe passage of the small astronomical

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body. About 500 California hippies, of a more skeptical turn of mind, went to Boulder, Colorado, in caravans of flower-painted Volkswagen buses, convinced that Icarus would hit and that the shock would detach California from the continent and make it slide into the sea.

It must have been about the forty-ninth time since the time of Christ that the end of the world had been predicted — these predictions average three per century — and as was the case forty-eight times before the world did not come to an end. Instead Icarus passed on June 14, 1968 at the rather safe distance of 4 million miles, and this time we have radar tracking to prove it. It was the first time that radar was used on a small body in space; the diameter of Icarus is about one-half mile. The tracking was done by the Goldstone station of the Deep Space Network in the Mohave Desert. An 85-foot dish beamed the radar waves at Icarus; the neighboring 210-foot dish served as the receiver. The problem of tracking Icarus by radar was similar in difficulty to tracking a silver dollar in orbit around the earth 22,000 miles from sea level.

At the time the Goldstone radars did their work, just 199 years had gone by since a trace on a photographic plate had received the designation 1949 M A. The designation, given in accordance with international astronomical usage, states that it was the first (A) planetoid discovery made during the second half of June (M) in that year. The actual date was June 26; the telescope had been aimed at the vicinity of the star Antares, and the exposure had been made by the late Dr. Walter Baade. It so happened that Dr. Baade's vacation was to begin the next day, so Drs. Seth B. Nicholson and Robert S. Richardson took over direction of the photographic tracking and should be considered as co-discoverers.

The first orbit calculation gave an aphelion of 183 million miles, some 40 million miles beyond the mean distance of Mars from the sun. Perihelion was then calculated to be 17 million miles from the sun, well inside the orbit of Mercury.

But the 1968 perihelion passage, on May 2, took place only 12 million miles from the sun. Whether the aphelion actually is at 183 million miles or a little farther out is not yet known. The orbital period is 409 days, which has the result that

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a close "fly-by" like that of 1968 will take place every 19 years.

After its discovery in 1949 the main question was whether Icarus would be "rediscovered" — that is whether it would be found again. As I know from conversations, the layman is a bit surprised that this should be a question at all. Astronomers, saddened by experience, know better.

Here is a short list of planetoids with orbits similar to that of Icarus; and all with diameters of one mile or less :

MALE PLANETOIDS APPROACHING EARTH TO WITHIN 15,000,000 MILES OR LESS

Name	Discoverer		Orbital Period (Years)	Eccentricity	Length of Major Axis (A.U.)	Minimum Distance from Earth (Mill.miles)	Inclination to Ecliptic (Years)
(1221)-Amor	Delporte,	1932	2.67	0.437	3.846	10.4	11°.9
Apollo (1932HA)	Reinmuth,	1932	1.81	0.566	2.972	2.5	6°.4
Adonis (1936CA)	Delporte,	1936	2.76	0.779	3.938	1.2	1°.5
Hermes (1937UB)	Reinmuth,	1937	2.0	0.50	2.580	0.22	5°
Icarus (1949MA)	Baade,	1949	1.12	0.827	2.156	4.0	23°

Of these, Apollo, Adonis and Hermes are "lost;" they were seen, or rather photographed, on one occasion only. Another planetoid with a similar orbit received the name Geographos — it also seems to be lost.

But the case of Icarus was a bit more auspicious. It was discovered first by Palomar Observatory in 1949, re-observed by Radcliffe Observatory in 1952 and in 1953 and, during the latter year, by the observatory at the Cape of Good Hope and the Bloemfontein Observatory. In 1958 Radcliffe Observatory secured more photographs and did so again in 1956. These successive observations indicated that the orbit, as re-calculated in 1952 by Dr. Samuel Herrick, was quite close to reality. The difficulties were mainly due to the small size of the object.

The trouble with orbital diagrams as they are published in newspapers is that they are flattened out and show a planetoid like Icarus crossing the orbit of the earth at two points like railroad tracks. It needs a three-dimensional diagram to show that Icarus and the earth are not on a collision course. The planetoid has its aphelion far "below" the

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ecliptic (the plane of the earth's orbit) and then climbs up, in a manner of speaking. When it reaches the ecliptic it is already inside the orbit of Mercury. Then it goes through its perhelion high "above" the ecliptic. It is only on its return journey back to its aphelion that is pierces the ecliptic *near* the orbit of earth; it never actually crosses the earth's orbit.

As long as Icarus follows this orbit, a collision is plainly impossible.

The earth then could only be endangered if the orbit of Icarus were changed in such a way that its descending leg actually passed through the earth's orbit. An orbital change could be brought about only by a perturbation caused by the gravitational field of one of the major planets or else by a collision in the asteroid belt when Icarus is near its aphelion. Both possibilities are unlikely because of the position of the orbit.

The high inclination of 23° of arc puts Icarus so far below the asteroid belt when it it at aphelion that it is definitely in a region where there are only a few strays from the main belt in evidence. And the inclination of the orbit also sees to it that Icarus never comes close to any of the larger planets, except our own planet.

A few weeks before the now historic fly-by, a member of the British House of Commons officially asked the government for "assurance that there would be no collision." I do not know what answer — if any — was given, but the nervous M. P. might have been told that even in space there is something resembling the survival of the fittest. Mars, as we now know, is heavily marked with ringwalls caused by the impacts of bodies that may be classified as either very large meteorites or very small asteroids. We all know what the face of the moon is like and the earth also received its share. A total of 40 large (*i.e.*, more than half a mile in diameter) impact craters are now identified as such and more than a dozen others are under suspicion. Of the large impact craters, the youngest is Barringer Crater in Arizona with an estimated age of 50,000 years. Most of them are many millions of years in age and it is an interesting fact that the biggest impact craters are also the oldest. The two largest in the Old World are the Vredefort Ring in South Africa with a diameter of at least 26 miles and Richat in Mauritania with a diameter of about 33 miles. The Vredefort Ring was formed during the Cambrian Period, about 500 million years ago. The age of the

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Richat crater has not yet been determined but it is at least as old as Vredefort.

In the western hemisphere the largest are the two Clearwater Lakes (20 and 16 miles) and Manicouagan Lake (40 miles), all three in Quebec. The so-called Sudbury Structure in Ontorio, of irregular shape and about 32 miles in length, is also of meteoritic origin. All four were formed before the Cambrian Period began and their minimum age is, therefore, 550 million years.

The implication of all this is that all the planetoids which once were in collision courses have ended their careers in the past. Those still orbiting the sun are the ones that are not on collision courses. Of course some smaller ones, presumably more numerous at any time, are still in collision orbits. Eastern Siberia was struck by about 20 tons of meteoritic iron on February 12, 1947, while another impact (believed to have been a very small comet) took place in Central Siberia on June 30, 1908.

The simple question of what happens when a meteorite strikes the ground does not have a simple or even a single answer. There are enormous variations and they depend on two factors. The nature of the meteorite, stony or iron, has nothing to do with it; the two factors are the mass of the meteorite and its impact velocity. Of course a falling mass of two tons will be different from a falling mass of two pounds, but the impact velocity is far more important. As everybody has learned in high school at one time, the kinetic energy of a moving body equals one half of its mass multiplied by the *square* of its velocity. Therefore, what happens on impact is mainly the result of the velocity involved.

Take the case of the famous Cape York (Greenland) meteorites, the largest of which, named Ahnighito, weighs 68,085 pounds. It was found by Commander Robert Edwin Peary, resting on a gravelly plain with rather hard ground. Since it had not been shattered on impact, the circumstances of its fall could be reconstructed as follows: Ahnighito and the other meteorites of that fall must have entered the atmosphere more or less parallel to the ground, like a re-entering artificial satellite. Somewhat slowed down by air resistance, it still moved nearly horizontally just before impact. The season must have been winter, with a thick snow cover at the impact site.

If the meteorite moves with equal "slowness" but impacts on ordinary soil, it will shatter and just dig a hole in the ground.

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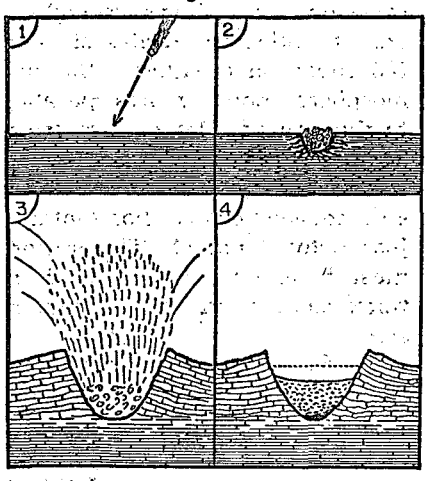
If the impact velocity is high, several miles per second, and the mass large, say more than twenty tons, we'll have a crater-forming impact, especially if the ground is bedrock with only a thin overburden of soil and sand. The enormous amount of kinetic energy shatters the rock of the ground as well as the impacting meteorite. The meteorite, in the process of shattering, will penetrate to a certain depth before the heat generated by the impact can make itself felt. By vaporization of part of the material a cloud of hot expanding gas is produced which acts just like the gases from an explosion. The force of the expanding gas acts in all directions, or rather it tries to do so. It cannot act too far downward, because the rock layer is, for practical purposes, of infinite thickness. It cannot act upward, because the explosion cloud expands faster than the speed of sound. So the atmosphere acts for a short time as a very heavy lid. Hence the force is acting mainly horizontally, pushing the top layers of the impact site outward in all directions from the center. More rock is broken up in the process and the rock layers around the rim, where the force is now too weak to break them, are tilted up.

The Process of Crater Formation.
1. A fraction of a second before impact
2. A fraction of a second after impact
3. Eruption of the explosion cloud
4. Two hours after impact; the dotted line indicates the original surface



When the explosion cloud, still confined to the debris-filled hole of its own making, has calmed down to the point that its rate of expansion is no longer greater than the speed of sound, the atmosphere lid is lifted. Now the explosion acts upward, carrying a large amount of the debris with it. Many of the larger pieces of debris both rock and meteorite fragments, are thrown from the hole like projectiles, falling around the crater within a radius of a few miles. This is the reason why one usually finds more meteoritic material in the vicinity of a meteorite crater than in it. A large amount of the shatter debris then falls back into the

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crater so that it is less deep when everything is over.

The foregoing description assumes that the impact takes place on solid rock; if the meteorite should fall on a volcanic area there will be secondary events, volcanic activity for which the shock of the impact acted as the trigger. Large flows of magma will take place, obscuring the original impact crater. The presence of other impact indicators — so-called shatter cones, caused by the impact shockwave in the ground — proves that there was an impact. Flows of volcanic material obscured most of the other features

The chain of events that produced the Sudbury Structure cannot be unique and the *maria* of the moon, the dark spots visible to the naked eye, have been under suspicion for a long time.

The well-known lunar craters like Tycho, Copernicus and Kepler are typical impact craters in solid ground, surrounded by small "secondaries" resulting from the larger pieces thrown out in the process of crater formation. Once impact craters on earth had been recognized, these lunar craters no longer presented any problems. But the large and generally smooth *mare* plains were more mysterious by far. The most convincing (but not then provable) explanation operated with a two-stage process. The first stage was a major impact of a planetoid, probably much larger than Icarus. The lunar crust was assumed to have been thin at the time so that the planetoid broke through the crust as an artillery shell will smash through the ice of a frozen lake. Then an enormous lava flow welled up through the hole, flooding the surroundings and covering up or melting down all then existing surface features.

This explanation, incidentally, was evolved before the Sudbury Structure was investigated. The rather important difference was that Sudbury is on earth and even in an easily accessible place, while the moon's *maria* are far away.

And even if one thought of astronauts landing on one of the *maria*, the astronauts would only be able to investigate the surface. They might say that it is indeed old lava, but that still would not be a clue to the reason for the lava flow.

Now, however, a confirmation has come from an entirely different and unexpected source. During the years 1966 and 1967 five Lunar Orbiters were put into orbits around the moon. The main purpose of these missions was to photograph the lunar surface in detail, both nearside and farside.

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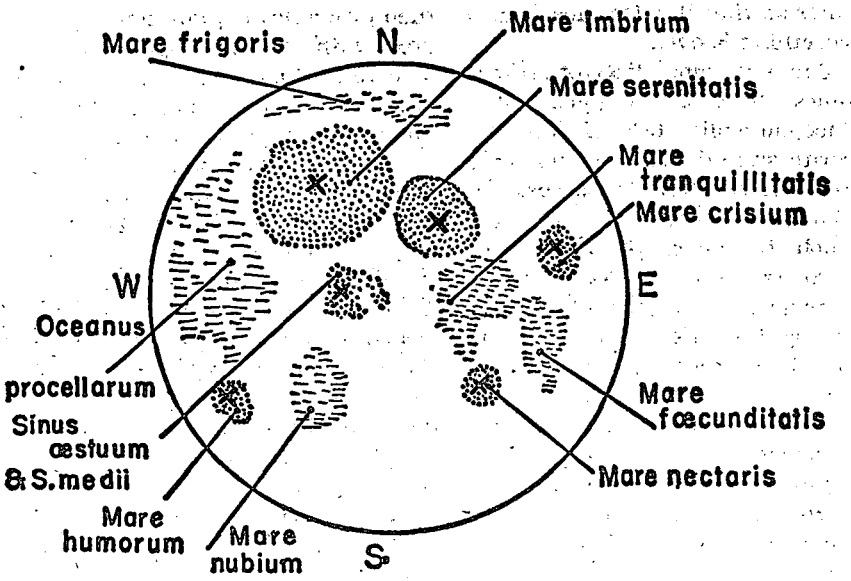

Sketchmap of the dark areas of the nearside of the moon, with crosses marking the location of six of the heavy masses. The seventh is located just beyond the rim of this sketch and is the only one that can be said to be located on the farside.

Then the orbit of Orbiter #5 was analyzed carefully, presumably to find out whether our moon has a faint equatorial bulge. Lunar Orbiter #5 was in a polar orbit around the moon but the data from the orbit of the #5 could be compared with data from the orbit of Lunar Orbiter #3 that had orbited the moon over its equator. The data agreed and we now know that there are seven heavy masses below the surface of the nearside. (See: map.)

The dark *maria* of the moon can be grouped by appearance as follows: *Oceanus procellarum, Mare tranquillitatis, Mare nubium* and *Mare frigoris* have irregular shapes. The others: *Mare imbrium, Mare serenitatis, Mare crisium, Mare nectaris,* and *Mare humorum* have regular, that is to say roughly circular, outlines. The heavy masses were discovered in, or rather under, the five circular *maria*. Another one is in the area of *Sinus medii*, a dark area in the center of the

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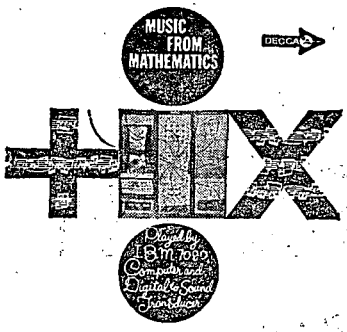

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nearside, and the seventh under the *Mare orientale*. The last named can be seen from earth only as a dark smudge at the rim of the nearside; the Orbiter protographs revealed it to be a magnificent circular structure.

Well, here we have a case of a theory that has been nicely confirmed by evidence that was discovered after the theory had been advanced. Of course the scientists who examined the data (P. M. Muller and W. L. Sjogren of the Jet Propulsion Laboratory in Pasadena) wondered just how large these heavy masses were. Since the orbital data cannot tell how deeply they are buried, an assumption had to be made, namely a depth of 30 miles below the surface. Under this assumption the mass under the *Mare imbrium*, if it consists essentially of iron, would be a sphere 60 miles in diameter. This is the size of a medium-large planetoid, far bigger than those that are known to have crossed the earth's orbit. And the former planetoids that produced the circular *maria* must have impacted the moon a long time ago, possibly at the same time that others of their kind caused the Vredefort Ring and the Sudbury Structure. —WILLY LEY

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THE LAST FLIGHT OF DR. AIN

by JAMES TIPTREE, JR.

None saw the woman with Dr. Ain.
Most had never seen her before . . .

Dr. Ain was recognized on the Omaha-Chicago flight. A biologist colleague saw him in an aisle seat while coming back from the toilet. Five years before, this man had been jealous of Ain's huge grants. Now he nodded coldly and was surprised at the intensity of Ain's response. If he had not had the flu like everyone else that autumn, he would have turned back to speak with Ain, but he shuffled on to his seat.

The stewardess handing out coats after they landed remembered Ain too: a tall, thin, nondescript man with rusty hair. He held up the line, staring at her; and since he already had his raincoat with him, she decided it was some kooky kind of pass and waved him on.

They both saw Ain shamble off into the airport smog, apparently alone. Despite the big Civil Defense signs, O'Hare was late getting underground. Neither of them saw the woman.

The wounded, dying woman.

Nobody recalled him on the flight to New York, but the 2:40 jet carried an Ames on the checklist, which was thought to be a misspelling of Ain. It was. The plane had circled for an hour

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while Ain watched the smoky seaboard monotonously tilt, straighten, and tilt again.

The woman was weaker now. She coughed, picking weakly at the scabs on her face that were half-hidden behind her hair. Her hair, Ain saw, that great hair which had been so splendid, was drabbed and thinning. He looked to seaward, willing himself to think of cold, clean breakers. On the horizon he saw a vast spreading black rug. Somewhere a tanker had opened its vents. The woman coughed again. Ain closed his eyes. It was the dead time of afternoon.

He was picked up next while checking in for the BOAC flight to Glasgow. Kennedy-Underground was a boiling stew of people breathing each other's reek, the air-conditioning unequal to the hot September evening. The check-in line swayed and sweated, staring dully at the newscast. *Save the last Green Mansions* — a conservation group was protesting the defoliation and drainage of the Amazon basin. Several people recalled the beautifully colored shots of the new clean bomb. The line squeezed together to let a band of uniformed men go by. They were wearing buttons inscribed: *Who's Afraid?*

That was when a woman noticed Ain. He was holding a newssheet and she heard it rattling in his hand. Her family hadn't caught the flu, so she looked at him sharply. Sure enough, his forehead was sweaty. She herded her kids to the side away from Ain. He was using *Instac* throat spray, she remembered. She did not think much of *Instac;* her family used *Kleer.* While she was looking at him, Ain suddenly thrust his head down and stared in her face, with the spray still floating above him. That made her mad. Such inconsiderateness! She turned her back. She did not recall him talking to any woman, but she perked up her ears when the clerk read off Ain's destination. Moscow!

The clerk recalled that too, with disapproval. Ain checked in alone, he reported. No woman had been ticketed for Moscow, but it would have been easy enough to split up the tickets. By that time they were sure she was with him.

Ain's flight went via Iceland with an hour's delay at Kevlavik. Ain walked over to the airport park, breathing gratefully the sea-filled air. Every so often he shuddered. Under the whine of bull-dozers, the sea could be heard running its huge paws up and down the keyboard of the land. In the little park were yellowed birches, and a flock of

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wheateaters foraged by the path. Next month they would be in North Africa. Two thousand miles of tiny wing-beats, Ain thought. He threw them some crumbs from a packet in his pocket.

The woman seemed stronger here. She was panting in the sea air, her large eyes fixed on Ain. He saw that the birches were as gold as those where he had first seen her, the day his life began. Squatting down to watch a shrewmouse, he had been, when he caught the falling ripple of green and recognized the shocking naked girl-flesh, creamy, pink-tipped among the golden bracken, coming towards him. Young Ain held his breath under stress, his nose on the sweet moss and his heart going *crash* — *crash* — and then he was staring at the outrageous fall of that hair down her narrow back, watching it dance around her heart-shaped buttocks while the shrewmouse ran over his paralyzed hand. The lake was utterly still, dusty silver under the misty sky, and she made no more than a muskrat's ripple to rock the floating golden leaves. The silence closed back, the trees burning silent like torches where the naked girl had walked the wild wood, and Ain's eye's were shining. For a time he believed he had seen an Oread.

Ain was last on board for the Glasgow leg. The stewardess recalled dimly that he had stayed awake. She could not identify the woman there were a lot of women on board. And babies. Her passenger list had had several errors.

At Glasgow airport a waiter remembered that a man like Ain had called for Scottish oatmeal, and eaten two bowls, although of course it wasn't really oatmeal. A young mother with a pram saw him tossing crumbs to the birds. When he checked in at the BOAC desk, he was hailed by a Glasgow professor who was going to the same conference at Moscow, This man had been one of Ain's teachers. It was now known that Ain had done his postgraduate work in Europe. They chatted all the way across the North Sea.

"I wondered about that," the professor said later. "'Why have you come round about?'" I asked him. He told me the direct flights were booked up. (This was found to be untrue; Ain deliberately avoided going to Moscow apparently as an amateurish attempt to avoid attention.

The professor spoke with relish of Ain's work.

"Brilliant? Oh, aye — and stubborn, too, very stubborn. It was as though a concept — often the simplest relation, mind you

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—would stop him in his tracks, fascinate him, so he would hunt all round it instead of going on to the next thing, as a more docile mind would. Truthfully, I wondered at first if he could be just a bit thick. But you recall who it was said that the capacity for wonder at matters of common acceptance occurs in the superior mind? And of course, so it proved when he shook us all up over that enzyme coding business. A pity your government took him away from his line, there . . . No, *he* said nothing of this, *I* say it to you, young man. We spoke in fact largely of my work. I was surprised to find he'd kept up. He asked me what my *sentiments* about it were, which surprised me again . . . Now, understand, I'd not seen the man for five years, but he seemed —well, perhaps just tired, as who is not? I'm sure he was glad to have a change; he jumped out for a leg-stretch wherever we came down. Oslo, even at Bonn. Oh yes, he did feed the birds, but that was nothing new for Ain . . . His social life when I knew him? Radical causes? Young man, I've said what I've said because of who it was that introduced you, but I'll have you know it is an impertinence in you to think ill of Charles Ain, or that he could do a harmful deed . . . Good evening."

The professor said nothing of the woman in Ain's life. Nor could he have, although Ain had been much with her in the university time. No one had seen how he was obsessed with the miracle, the wealth of that body . . . her inexhaustibility. They met privately at his every spare moment, sometimes even in public, pretending to be casual strangers under his friends' noses, pointing out a pleasing view to each other, gravely formal. And later — what doubled intensity of love! He revelled in her, possesed her and searched over every atom of her — the sweetest springs and shadowed places and the white rounded glory in the moonlight— finding always more, always new ways to never-failing delights. The danger of her frailty was far off then in the rush of birdsongs and the springing leverets of the meadow. On dark days she might cough a bit, but so did he. In those years he had had no thought to the urgent study of disease . . .

At the Moscow conference nearly everyone noticed Ain at some point or another, which was to be expected in view of his professional stature. Ain was late in; a day's reports were over, and his was to be on the third and last. It was a small high-calibre meeting. Many people spoke with Ain, and several sat with him at meals. No one was

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surprised that he spoke little, since he was a retiring man except on a few memorable occasions of hot argument. He did strike some of his friends as a bit tired and jerky. An Indian molecular engineer who saw him with the throat spray kidded him about bringing over Asian flu. A Swedish colleague recalled that Ain had been called away to the transAtlantic phone at lunch; and when he returned Ain had volunteered the information that something had turned up missing in his home lab. There was another joke, and Ain said cheerfully, "Oh yes, quite active." At that point one of the Chicom biologists swung into his daily propaganda chore about bacteriological warfare and accused Ain of manufacturing biotic weapons. Ain took the wind out of his sails by saying: "You're perfectly right." By tacit consent, there was very little talk about military applications, industrial dusting, or subjects of that type. And nobody recalled seeing Ain with any woman other than old Madame Vialche, who could scarcely have played Mata Hari.

Ain's own speech was bad, even for him. He always had a poor public voice, but his ideas were usually expressed with the lucidity so typical of the first-rate original mind. Ths time he seemed muddled, with little new to say. His audience excused this as the muffling effects of security. He then got somehow into a tangled point about the course of evolution in which he seemed to be trying to show that something was very wrong indeed. When he wound up with a reference to Hudson's bell bird "singing for a later race," several listeners wondered if he were drunk.

The big security break came right at the end, when he suddenly began to describe the methods he had used to mutate and redesign a leukemia virus. He explained the procedure with admirable clarity in four sentences and paused. Then he said other sentences about the effects of the mutated strain. It was maximal only on the higher primates, he said; recovery rate among the lower mammals and other orders was close to 100%. As to vectors, he went on, any warm-blooded animal served. In addition, the virus retained viability in most environmental media and performed very well airborne. Contagion rate was of course extremely high. Almost off-hand, he added that no test primate or accidentally exposed human had survived beyond the twenty-second day.

These words fell into a silence broken only by the running feet of a Chicom delegate making for

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the door. Then a gilt chair went over as an American bolted after him. Ain seemed unaware that his audience was in a state of unbelieving paralysis. It had all come so fast. A man who had been blowing his nose was staring popeyed around his handkerchief. Another who had been lighting a pipe grunted as his fingers singed. Two men chatting by the door had missed his words entirely, and their laughter chimed into a dead silence in which echoed Ain's words: " — really no point in attempting."

Later they found he had been explaining that the virus utilized the body's own immunomechanisms, and so defense was by definition hopeless.

That was all. Ain looked around vaguely for questions and then started down the aisle. By the time he got to the door, people were swarming after him. He wheeled about and said rather crossly, "Yes, of course it is very wrong. I told you that. We are all wrong. Now it's over."

An hour later they found he had gone, having apparently reserved a Sinair flight to Karachi. Our security men caught up with him at Hong Kong. By then he seemed really very ill, and went with them peacefully. They started back to the States via Hawaii. His captors were civilized types; they saw he was gentle and treated him accordingly. They took him out handcuffed for a stroll at Osaka. He had no weapons or drugs on him, and they let him feed his crumbs to the birds, and listened with interest to his account of the migration routes of the common brown sandpiper. He was very hoarse. At that point, he was wanted only for the security thing. There was no question of a woman at all.

He dozed most of the way to the islands; but when they came in sight, he pressed to the window and began to mutter. The security man behind him got the first inkling that there was a woman in it, and turned on his recorder.

" . . . blue, blue and green until you see the scabs. Oh my girl! Oh beautiful, you won't die. I won't let you die. I tell you, my girl, it's all over now, hold on, it's over . . . Lustrous eyes, look at me, let me see you now alive my girl. Oh great queen, my sweet body, my girl, have I saved you? Oh terrible to know, and noble — Chaos' girl green-robed and blue, in golden light . . . the thrown and spinning ball of life against black space. Have I saved you?"

On the last leg, he was obviously feverish.

"She may have tricked me, you know, he said confidentially to the government man. "You have

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to be prepared for that, of course. I know her!" He chuckled confidentially. "She's no small thing. But wring your heart out — ."

Coming over San Francisco, he was merry. "Don't you know the otters will go back in there? I'm certain of it. That fill won't last, there'll be a bay there again."

They got him on a stretcher at Hamilton Air Base, and he went unconscious shortly after take-off. Before he collapsed, he'd insisted on throwing the last of his birdseed on the field.

"Birds are of course, warm-blooded," he confided to the agent who was handcuffing him to the stretcher. Then Ain smiled gently and lapsed into inertness. He stayed that way almost the whole remaining ten days of his life. By then, of course, no one really cared. Both the government men had died quite early, just after they finished analyzing the birdseed and throat-spray. The woman who had seen him at Kennedy was only just then feeling sickish.

The tape-recorder they had put by his bed functioned right on through, but if anybody cared to replay it, they would have found little babbling. "Gaea Gloriatrix!" he crooned. At times he was grandiose and tormented. "Our life, your death!" he yelled. "Our death would have been your death too, no need for that, no need — " At other times he was accusing. "What did you do about the dinosaurs?" he demanded. "How did you fix *them*? Did they annoy you? Cold. Queen, you're too cold! You came close to it this time, my girl," he raved. And then he wept and caressed the bedclothes and was maudlin.

Only at the end, lying in his filth and thirst, still chained where they had forgotten him, he was suddenly coherent. In a light, clear voice, as one might ask one's lover what to take on a summer picnic, he asked the recorder happily:

"Have you ever thought about *bears*? They have so much — funny they never came along further. By any chance were you saving them, girl?" And he chuckled in his ruined throat until he died.

—JAMES TIPTREE JR.

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THE THEORY AND PRACTICE OF TELEPORTATION

by LARRY NIVEN

There's more to teleportation than talent. It takes skill and knowledge to do it right. Here's how!

I

Why teleportation? Well — Last March I was Guest of Honor at the Boskone, the regional fan convention held annually in Boston. Strangely, everyone seemed to expect a speech. I hadn't done any speaking since early college. Worse, the audience was jammed with MIT students.

Why teleportation? Because that way none of the MITSFS (MIT Science Fiction Association, pronounced "misfits") could catch me at anything. What with no firm ground for believing that teleportation is even possible, there would be endless room for speculation without any way for some teenage genius to tell me, "You're wrong! Right here in my physics text it says — "

At that, there was enough argument. But the speech went well, even to the point where the question session degenerated into frenzied arguments near the back wall, allowing me to slip quietly away. I'd planned that. But Fred Pohl caught me at the door and asked me to turn the speech into an article for him. Here it is.

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Disclaimer: Any resemblance to the plot of ancient or modern science fiction, novels or short stories, is *not* coincidence. I've been reading science fiction, voraciously, for eighteen years. In most of what follows, I have borrowed freely from my betters, and even from my own stories. Where I remember my sources, I have quoted them — sometimes.

Definition: Teleportation is any method of moving from point to point in negligible time. Over short distances we will take light-speed as negligible. Over longer distances (interplanetary and interstellar) we will require infinite or near-infinite speed.

I make a distinction between psychic and mechanical teleportation. Essentially, psi teleportation involves an individual's wishing himself from place to place. In mechanical teleportation he pushes a button. He may do other things first, such as sighting in, charging batteries, weighing and measuring his cargo, whatever it takes. But eventually he will push a button *here* and he will instantly be *there*. Similarly, the adept at psi teleportation may have spent decades in spiritual training, learning to negate distance by the power of a wish.

These definitions are not meant to be rigorous. Intuitively you know what teleportation is, anyway.

History: The history of teleportation is all of the psi variety.

The prophet Elijah was frequently "transported" by Jahweh. He would rise in the air, spin around a few times, then vanish. Or he would fly about and come down without vanishing. One day he flew up and up and never did come down. His followers searched the countryside for days. When they couldn't find his body they assumed that Elijah had taken it with him, into Heaven.

Friar Joseph of Copertino (1603-1663) was a levitator. Usually in the presence of witnesses, he would go into a religious trance, rise into the air, fly about, eventually settle on an altar or in a tree. His presence in this article derives from his power of bilocation. Friar Joseph was capable of being in two places.

Then there are past and present Hindu mystics and tales of teleportation during seances. No matter. The interesting thing is that, historically, nobody seems to make a distinction between negating distance with a wish, flying by flapping one's arms, flying *without* flapping one's arms, being in two places at once, or being blown about at terrific speeds by divine or other mysterious forces. The distinction seems to be original with sience fiction; it has no basis in recorded "fact."

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I offer the thought that there may be no distinction, that this confusion may be a fundamental characteristic of psychic teleportation.

Theory of Psychic Teleportation: I'd like to get through this fairly quickly, since I don't believe in psi teleportation and since my major interest is in the effects of teleportation on society.

1.) Consider the following theory: *A man in deadly danger would learn to teleport in order to save his life.*

I can remember two novels in which the idea was crucial: *Jack of Eagles*, by James Blish, and *The Stars My Destination*, by Alfred Bester. The idea is simply to point a gun at a man's head and fire. One time out of a thousand he will frantically teleport out of the way of the bullet, and you will have a teleport.

Forget it. There has been too much opportunity for it! Violent death has occurred since man was definably man. How many have learned to teleport in time to save their lives? Too few to be noticed.

But there's another flaw in the theory. Psychic powers are notoriously undependable. Experience says that when the ability to teleport is most needed, that's when it won't show up.

2) My prejudice against teleportation has a valid basis. I haven't seen it.

Science has existed on earth for — depending on how you define science — between a couple of centuries and a few millennia. We can't yet build a hardware-type teleport system. But psi powers, if they exist at all, have been around since man was definably human. If teleportation is both possible and useful, we should have been using it since men moved into the Nile Valley. And we would never have given it up . . . if teleportation is *both* possible *and* useful.

We conclude either that teleportation is not possible, or that it kills those who possess the gift before they can demontrate it to anyone. Both are possible.

Consider Bester's "Blue Jaunt." A man in a panic, drowning, teleports without considering where he's going. He ends up inside a wall. BOOM! Bad trip.

Or, psi could be dangerous in other ways. Gene-linked to insanity or to mental deficiency, for example.

In any case, psi teleportation is out. But let's ignore facts and do some speculating.

Practice of Psychic Teleportation: What about conservation of energy? What of conservation of momentum?

These questions are not idle.

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Stones did not stop falling when Einstein published a new theory of gravitation. The old laws hold; new laws of physics usually apply only to new areas of observation. Changing one physical law is like trying to eat one peanut.

Okay. So what happens if you try to teleport uphill? Does your body get colder or lose mass? There is a gain in potential energy. It must be compensated by the loss of energy of another form.

Suppose I were to teleport to Kerguelen Island? (I am writing in Los Angeles. Opposite me on the Earth's globe is the heart of the Indian Ocean, in which Kerguelen Island is the nearest land mass.) Because of the Earth's spin, Los Angeles and Kerguelen Island are going in opposite directions. Were I to teleport to Kerguelen Island I would have to land running — at half a mile a second.

Teleportation can be dangerous. You don't teleport out of a speeding car either.

3) I take another theory of psi teleportation from *The World of Null-A,* by A. E. Van Vogt. It seems that two objects similar to each other to twenty decimal places will join each other. The lesser will bridge space to contact the greater. This presumed law applied to masses, thought waves and even whole personalities.

We can't disprove it. It could be a fact. We can't disprove it because Van Vogt never defined similarity, nor greater, nor lesser. So now you know how to write a science-fiction story. But we can still work with the idea; and I believe Van Vogt missed some great comic routines. Take this one:

In one scene in *The Pawns of Null-A,* we see Gilbert Gosseyn on one side of a fence. He wants to be on the other. So he looks at a piece of land just beyond the fence and, with the power of his extraordinary brain, he tunes himself to that piece of land, adjusting his own atomic makeup to a similarity of within twenty decimal places.

Now, twenty decimal places is pretty finicky. Gosseyn must get within that range, but he must also make sure that he will be the lesser of the pair, and not the greater. One slight slip . . .

So he makes the bridge . . . and half a ton of earth descends on him.

I don't believe in psychic teleportation. But I could be wrong. So:

We will assume that it is possible for nearly anyone to learn to teleport. A new learning technique has been developed. It may be serving DNA or RNA molecules in one's food, tailoring them to carry a superficial mem-

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ory directly to the brain, as we now feed flatworms to each other to transfer learned responses. It may be something else. What do you get, when nearly everyone on Earth can teleport?

You get Alfred Bester's *The Stars My Destination*. I offer the book as a text to accompany this course. I'll name a few highlights:

Thieves, uncatchable or nearly so, who teleport around the world to follow the night. They never see sunlight.

Locked doors, and behind the doors, mazes complex enough to confuse anyone who might try to teleport inside. Otherwise there would be no private property, nor privacy either.

Transport vehicles become obsolete. Collectors collect them as period pieces.

Classification of each citizen's teleport characteristics (Bester assumes a distance limit. My own question: is the limit due to relativistic uncertainty? The more distant is one's destination, the less certain is its location in space and time.)

Intensive, probably productive research into other psi powers (since one has been shown to exist).

I object to one thread of Bester's tapestry. If Gully Foyle tries to "jaunt" along a "geodesic curve" he will end by going slower than light. That's how geodesics work in Einsteinian space. But it doesn't affect the pattern of Bester's society, which is worth studying.

II

Theory of Mechanical Teleportation: Anyone know anything about tunnel diodes?

The field is full of good writers named Smith. One wrote a story using a teleportation system based on the tunnel diode effect. Apparently physics students are now taught that a tunnel diode takes an electron *here* and puts it *there* without allowing it to occupy the intervening space. If you can do it with quantum physics, why not with larger masses? With people? The theory looks good, and it hasn't been used much in science fiction.

Older, more often used, and more traditional is the beaming method. You convert your passenger and/or cargo to electromagnetic waves, fire the beam across space, catch it in a receiver and convert the electromagnetic energy back into matter.

A modification is Poul Anderson's system in *The Enemy Stars*. Poul's system records the position and energy state of every subatomic particle in the passenger's body. A side effect is that the body is vaporized, so

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that that one winds up with a complete record of the passenger plus a cloud of superheated plasma. The gas is sucked down through a grid into a matter reserve, to await the next incoming signal.

The record of the passenger is fired across space. A receiver picks it up and uses it, plus the plasma in its own matter reserve, to reconstruct the passenger.

I don't know. I wouldn't ride in one of the damned things.

The engineering problems seem trivial compared to the legal, ethical, and philosophical ramifications. Still, what happens if the signal gets snarled up? In the good old days I read of the possibilities in EC comic books; and the pictures were vivid and horrifying.

In practice, the least bit of interference would leave the passenger an idiot or a good imitation of a corpse. Over interplanetary distances you'd have to worry not only about intervening dust and gas, but about red and violet shifts due to gravity and relative velocities. And what happens to your soul?

I worry about that. I don't necessarily believe in a soul, but I don't believe in taking chances.

If my soul isn't recorded somewhere in the process, I'm dead, even though my memory remains as reconstructed electron tracks.

Where society is concerned, there are equally serious problems. Let's say we've reached step one. We've recorded our customer, and we now have a record and a ball of ionized plasma. Why not beam the record to two receivers? Now we've got a duplicator. The legalities get sticky. We could get around them by permitting one, say, one Isaac Asimov to a planet; but who gets the royalties on the *Foundation* trilogy?

Similarly, you can keep the record. You fire the signal at the receiver, but you store the tape. Ten years later the passenger walks in front of a bus. You can recreate him from tape, minus ten years of his life. But — aside from questions concerning his soul — can he collect his own life insurance?

Suppose we change our mind after step one. We store the tape instead of firing it. Is it kidnapping? Or, in view of the fact that we have mortally vaporized a man, is it murder? Does it cease to be murder if we reconstitute him before the trial?

Finally, we assume an advance whereby we needn't destroy the model to get the record. Should not we destroy him anyway? Otherwise he hasn't *gone* anywhere.

Our fourth method doesn't have these difficulties. It is often called transposition or teletrans-

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position, but that's too much work. Henceforth I'll call it teleportation. It involves making two points in space contiguous . . . somehow. Generally we take advantage of the fact that the universe, as viewed from four or more dimensions, resembles a crumpled handkerchief. Light follows the contours of the handkerchief, so that spaces which are really contiguous in four or more dimensions do not look contiguous when viewed across apparently flat space.

If the universe does not in fact resemble a crumpled handkerchief, maybe we can *make* it resemble a crumpled handkerchief. It may be possible to bend the fabric of space by the judicious application of electromagnetic fields, until two points touch. At least we get no embarrassing duplication of passengers.

The embarrassment arises if two sets of machines are in operation at once, *anywhere in the universe*. At best, space will be bent in some unanticipated way, and nobody will get where he wants to go. At worst, the fabric of space comes apart like a too-often crumpled handkerchief.

Development of Mechanical Teleportation: Assume we have a teleportation transmitter and receiver. How we got these is a matter for science fiction; but once we have them we can move onto surer ground. We assume that the principle does not involve beaming; it may involve tunnel diode effects or space-bending or something new.

So we've got two enclosed booths . . .

Why booths?

Because of an old principle that two bodies cannot occupy the same space at the same time. Like a lot of old principles, this one isn't strictly true. Matter is mostly empty space. There is no reason why you can't teleport into a rock there's plenty of room for your atoms and the rock's atoms. Trouble is it'll kill you.

Teleporting into a mass of air will kill you too. There are energy factors involved, and also bends, embolisms, etc. Probably there will be an explosion.

So you need booths. Naturally the interior spaces are identical in size and shape. The transmitter booth includes air as well as the passenger cargo. The receiver is evacuated. We teleport the air as well as the passenger and/or cargo.

If what we have are transceivers, we need not evacuate the receiver. We teleport its air to the transmitter as we teleport the cargo to the receiver.

With development, we may be able to do away with the booths. If we expand a spherical force

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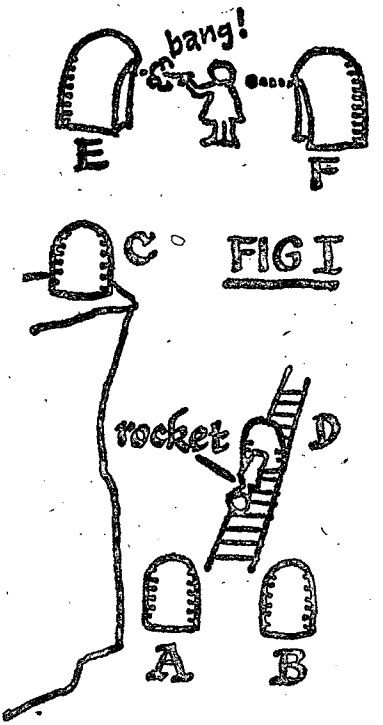

field from a point (GREE stories, from *Galaxy*) to get a vacuum for the receiver, we need only a transmitter booth. Put the passenger in a pressure suit, and we eliminate that booth; it doesn't matter how big a volume gets sent along as long as the volume of the receiver is bigger.

But we'll have to start with booths.

Now turn to Figure I.

Booths A and B are used for the first stages of experiment, to find out if we can teleport reliably.

Once they are working well we move to step II: teleporting instruments from booth C to E and (if transceivers) back again. If conservation of energy holds we expect a rise in temperature from teleporting down that cliff.

Booth D is built on railroad tracks. We set it moving to determine if conservation of momentum holds. Given relativity we might as well use booth D as receiver only. Thus we can pad the back wall, in case conservation does hold.

Booths E and F test for continuous teleportation. Bullets are fired into the opening in E at various speeds. Which bullet will reach F before it strikes the back wall of E? This system could stand redesigning. Obviously we can't pad the back wall of E; we'd only teleport the padding to F. Thus we destroy a teleport booth every time the bullet hits the back wall of E. When the bullet teleports in time it zings out of booth F and hits the scientist. If the scientist ducks, the coward, the bullet will still destroy booth E.

We can get better data with a long crossbow bolt, by measuring what length of the bolt gets teleported in time. But we destroy the booth with the arrow

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head and clonk the scientist with the feathered end. I'm sure there's a better way to design this system.

III

Practice of Mechanical Teleportation: Here my theme becomes complex. I intend to demonstrate that any limitations we assume for our teleportation system are going to imply a society: one society for each set of limitations. Again, I will quote my sources where I can remember them, sometimes. But much of what follows is my own.

The assumption: We do not need a transmitter. Our teleport receiver will bring anything to itself, from anywhere. Limitations may exist as to distance or mass of cargo.

The result: Thieves capable of stealing anything from anyone in perfect safety. Such machinery was discovered by Seaton, and later by DuQuesne in THE SKYLARK OF SPACE. In practice, anyone who has such machinery is king of the world. If many men have transmittterless receivers, society falls apart. When society stops making parts for the machines, the machines fall apart, and everything starts over.

The assumption: No receiver is needed. Our teleport transmitter will place its cargo anywhere.

The result: We can put a bomb anywhere. The idea was used at least once, in *The Person from Porlock*. In practice, a government that owned one of these would own the world. Two such governments would probably bomb each other back to a pre-teleport level of civilization.

Given the two above assumptions, you don't really get a society. You get a short war. Hence most stories assume that teleportation requires a transmitter and a receiver.

Let's do the same. Let us further assume that transmitters (transceivers?) look like telephone booths. You walk into a booth, you put a coin in the slot, you dial. You're elsewhere.

How do they work? We assume either space-bending or the tunnel diode effect. We assume the operation is relatively cheap: no more than a few quarters in the slot. Finally, a slug in the slot will send the customer straight to police headquarters.

The result: All present transportation becomes obsolete: cars and trucks and freeways, ships and train stations. What do we do with a continental net of freeways once the cars and busses have disappeared? You use them for drag races and bicycle riding; you put houses on them or turn them into parks. Or you

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pack them with cars because there's no place else to put the damn useless cars. Not only freeways and turnpikes, but streets and roads and even sidewalks become obsolete. In business district you keep the sidewalks for window shopping. Elsewhere, pfftt!

The mind boggles. Assume the population problem continues in the direction it's going. Then, as Isaac Asimov has suggested, new generations could grow up without seeing the exterior of *any* building, including their own homes. There might soon be no countryside to see in any case, and precious few exteriors to buildings. Without need for streets or sidewalks, there would be no space between buildings; They would be built wall to wall, or in units a mile cubic. And the people get their exercise by riding bicycles between two open booths arranged like E and F in Figure I.

But suppose there are limitations on the booths? For each assumed limitation one gets a different society. Let's take a few examples.

The assumption: Booths are expensive to operate. The price for any jump, regardless of distance, is two hundred dollars. (A reasonable restriction. Any space-stressing operation might well cost as much as any other. Ditto for a single tunnel-diode operation.)

The result: Cars, motor scooters, busses will remain. Except for emergencies, nobody would use the booth for distances shorter than a transcontinental flight. But airplanes would disappear, except perhaps for cargo flights.

Change the price, and you change the result. As price goes down, freight traffic by train and truck dwindles, and then even automobiles begin to go. Raise the price to a few thousand dollars, and only spacecraft disappear.

The assumption: The booths are cheap, a couple of bucks a jump, but limited as to distance. Ten miles, let us say, is the upper limit.

The results: A traveler would move in hops, naturally. But there would come a point where an airplane is cheaper or more convenient, or both, than a succession of teleport booths. Thus cars would go, but airplanes and shipping would remain.

Change the limiting distance and, again, you change the society. At a mile a jump only the cars go. At a thousand miles a jump, only spacecraft remain.

The assumption: Teleportation is limited by the Laws of Conservation of Energy and Momentum.

The Result: Not very differen

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from above. Cars would go; airplanes would remain. By teleportation we could not travel long distance north and south; we would have to do it on short hops. The longer the hop, the harder momentum would jerk the passenger sideways each time.

Traveling east, our momentum would lift us a few inches from the chair of the receiver booth on each hop. (Yes, I said chair. *You* might try it standing up, but I wouldn't.) Traveling west would be worse: momentum would slam you down hard. A New Yorker might prefer to reach San Francisco via the western route in a line of booths crossing the Atlantic and Pacific Oceans.

Notice one important exception. We can travel from the northern hemisphere to the southern in perfect comfort, provided the departure point and destination are at corresponding latitudes.

Elevators become more important than ever. In Earth's gravitational field, at ground level, we lose seven degrees Fahrenheit for every mile we teleport upward . . . and we gain as much going downhill. Elevators are more comfortable.

So: you want to go skiing in the Swiss Alps, at St. Moritz.

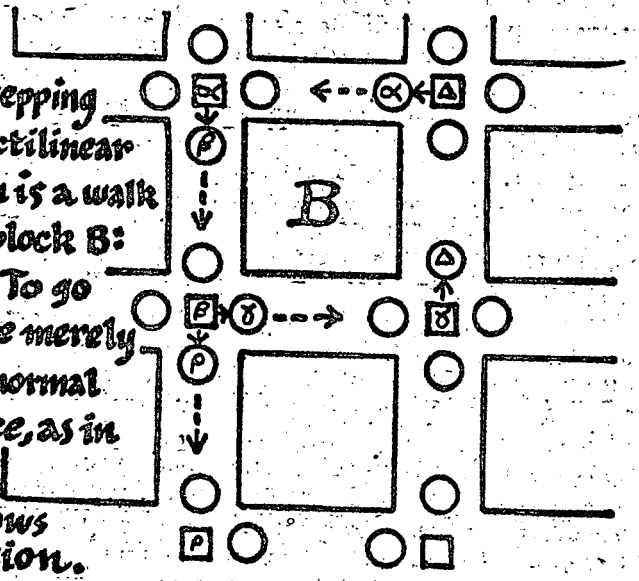

FIG. II
Layout of stepping discs in a rectilinear city. Shown is a walk around the block B: α, β, δ, Δ, α. To go straight, one merely maintains a normal walking pace, as in β thru ρ. Dotted arrows = teleportation.

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From the United States your best bet is to take a plane to someplace with a big landing field, ride an elevator half a mile up to a teleportation booth, then teleport to St. Moritz. Do it any other way and you wind up sick for a couple of days. And from New York you can reach Angol, Chili in one jump.

So much for the booths. They still look like our best attempt at prophecy; but let's try some wilder ideas and see what we get.

The assumption: Our teleport discs. You step on a disc, it teleports you to another disc. Cost, pennies per thousand trips.

The results: All present transportation disappears. With the proper setup, you can *walk* anywhere on the planet. Figure II is a design for intercity transportation, but it can easily be adapted for longer distances. The blocks shown could be lines of longitude and latitude; their length is optional.

For the rectangular city layout shown, we simply walk in the direction we wish to go. The distance between the receiver plate, at the center of the intersection, and the next transmitter disc is about three paces. In three paces one covers a block, whose length, I repeat, is optional. Perhaps there would be faster lanes through the center of town, and faster still between towns: intersections a mile or ten miles apart. To get out of the system one walks *around* the final disc and goes window shopping or whatever.

The biggest advantage is that we can give up all the dialing.

The assumption: Our transmitter is hand-sized. We can hang it from our belt. It has a telephone-type dial on it. The receiver is bigger: an open platform, either a small plate at home, in vestibule, or a community receiver the size of a public square. Cost is equivalent to the cost of using a telephone. There are (if necessary) compensators for momentum--and heat-transfer in the receiver plates.

The results Bester's *The Stars My Destination,* with minor changes. No mazes behind the doors; simply unlisted receiver numbers.

Shall we design a few spacecraft? Limited teleportation might not make spacecraft obsolete. It might even be used to improve the spacecraft themselves.

The assumptions: Teleportation requires both a transmitter and a receiver. Conservation holds. Teleportation is instantaneous and does not involve beaming.

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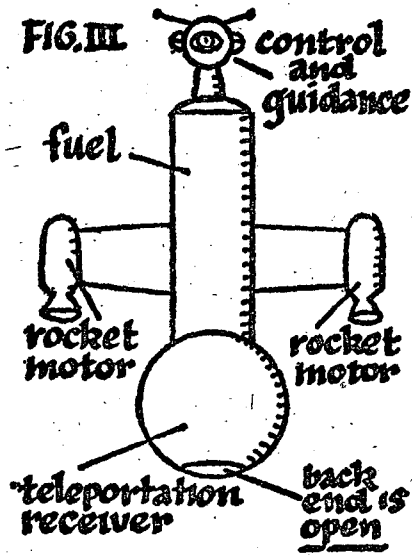
The result: See Figure III. The ship consists mainly of a couple of rocket motors, fuel tanks, and an open-ended teleportation receiver open to the rear. You can leave it open because, in vacuum, you don't need to worry about air getting in the receiver.

The ship, unmanned, is fired from Earth orbit or from further out. Probably it should be fired in the direction of the galactic core, where we anticipate more traffic. By firing the ship from, say, Jupiter orbit, we can pack quite a lot of fuel — water, for reaction mass — *outside* the ship. (See Asimov *The Martian Way*).

We use all the fuel except a reserve for steering. The ship coasts.

It passes through a star system. Let it be about the size of the solar system; then we have ten hours (assuming our ship is near lightspeed) to shove an entire prefab colony into the Earth-based transmitter. If all ten hours are used, then the colony building materials are strewn across the entire system. Each piece of equipment arrives at rest with respect to Earth and thus leaves the receiver at a speed approaching lightspeed. (Now you know why we put a hole in the receiver.)

Last through the receiver are the ships designed to collect all this junk. Since they are manned,



we had better not send them from Earth. Conservation of energy would freeze the pilots to ice in an instant. Consider the irony: to keep them from freezing, we must ship them from Pluto orbit!

It might be more efficient to send through the teleport system only a few ships and another prefab teleport receiver. The rest of the colony comes through the second receiver.

In any case, notice four advantages. You don't have to carry the entire cargo or waste fuel accelerating it. You don't decelerate the ship, so none of your limited fuel supply need be reserved for that purpose. The col-

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onists need not twiddle their thumbs for decades. And the ship can be re-used. Can and will. You just let it coast. Every time it comes near a star system, you have another colony. In eighty thousand years we leave a line of colonies clear across the galaxy, before we finally run out of stars.

Less peaceful societies would shove war fleets through the teleport system. It is hard to imagine a safer way to make war. The fleet is strewn all across the system, with all the warships at rest with repect to the universe at large. And how could the target system counterattack? To reach the invading system, they would have to catch a ship which has had years to accelerate to its tremendous velocity, and which is long gone into interstellar space before the attack can even begin.

IV

During the Boston speech, a member of the audience suggested that teleportation be used to fuel the above craft. Specifically: the motor is a receiver, open, with a flared nozzle attached. We drop a transmitter on Jupiter. Presto! Hellishly dense high-pressure gas expands explosively into the vacuum of space, driving the ship forward. Fuel supply: inefficient compared to ion drives or the like, but almost literally unlimited.

It won't work. Rather, it won't work for long.

Remember, we have assumed that conservation holds. The motor's exhaust velocity is the ship's own limiting velocity if we use teleportation to fuel the ship. Jupiter's atmosphere wouldn't expand fast enough to be useful. Even with a fusion drive, we lose momentum every time a droplet of hydrogen reaches the fuel tank. We have to get it back by firing the droplet through the rocket motor. When the two balance . . . we can't go any faster.

Total conversion of matter to light does give us unlimited velocity. Then we have only the problem of what to do with the incoming fuel. We *always* have that problem. A droplet of hydrogen moving at a tenth of lightspeed would vaporize any fuel tank we can build today. Maybe in the future . . . with new materials . . . plenty of padding . . . springs . . .

Let's try something else.

The assumptions: The distance one can teleport is relatively restricted. The greater the curvature of space — that is, the greater the proximity to a large mass — the shorter is the limiting distance. We will assume that on Earth the limiting distance is two

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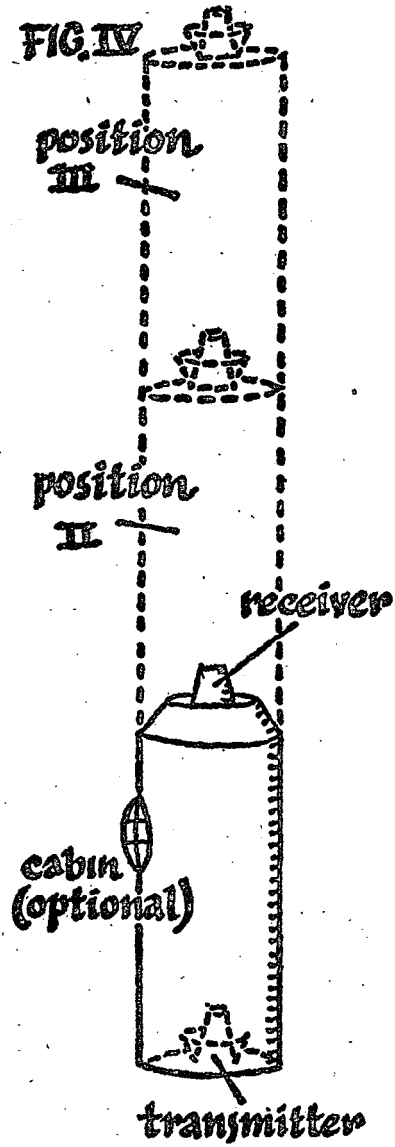
feet; around Mar's orbit, some miles; between stars, a few light-minutes. Attempt to send a mass beyond the limiting distance, and it will emerge from the receiver as a fluid or a fine dust. The curvature of space distorts the relationships between atoms too greatly.

Again, we assume the conservation laws hold.

The results: Feeble as far as teleportation is concerned. We can teleport fluids, so fuel tanks disappear except for storage tanks and spacecraft. The best we can do for spacecraft is fuel a booster, with a heavily armored fuel tank, designed to lift spacecraft out of a gravity well at low speed. But we can use the system to build a ship . . .



See Figure IV. We'll call this peculiar object the "end-teleport drive," and we'll say that it teleports itself onto its own front end. I invented it many years ago, but I never had the nerve to write a story about it.

Notice that if you push the button, the ship teleports onto its own front end; but if you held the button down, it will teleport repeatedly, in a steady stream of images.

One jump brings the ship to position 2 but the moment it begins to occupy position 2 it wants to be at position 3; as that

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image starts to form, the ship wants to be at position 4, *et cetera*. If teleportation is rapid enough we can use it for transportation.

You refuse to believe in my ship? Then think of it, as an exercise in speculation. Ridiculous as it may seem, we do get results:

1) Rate-of-travel of the ship is limited only by mechanical difficulties, that is, by the rate of successive teleportation. The end-teleport drive does not effect the ship's kinetic energy. We change only the position. So there is none of this nonsense about relativity.

2) We *must* assume a mechanical limit on rate-of-travel. Otherwise the ship goes off the edge of the universe.

3) You can take your finger off the button. Kinetic energy is teleported along with everything else; and as a perfect image you have free will.

4) The longer the ship is, the faster it will go, with a given rate-of-teleportation. But: the longer the ship is, the greater is the danger of getting too near a large mass. To land on Earth the ship would have to be less than two feet long.

In fact, you can't land it anywhere with the end-teleport drive. As with the inertialess drives in Doc Smith's *Lensman* series, you keep an intrinsic velocity which reappears when the drive goes off. To land the ship anywhere you need either inboard auxiliary rockets or rocket tugs.

5) What happens if something gets in the way of the ship?

Good question. Many things definitely will. Light, for example.

A light beam crosses interstellar space. Suddenly, for an instant, the end-teleport ship is occupying that space. The ship's walls can't stop it, for the light never encountered the walls. A human eye can stop it if the light happens to reach that eye in time.

Result: everything on the ship is transparent. If we assume that some light will be picked up by the teleportation field and carried along with the ship, then how transparent everything is will depend on two things: the rate of travel and the distance of an object from the passenger's eye. His hand is nearly opaque. The further wall is nearly invisible, because so much light is being picked up in the space between wall and eye . . . and *dropped* between wall and eye. The cabin in Figure IV is unnecessary unless the ship carries rocket auxiliaries. With the end-teleport drive going, the stars are visible anywhere you look.

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If the teleportation field will *not* transport light, the situation becomes more serious. At a useful rate of travel a light beam would have just time to traverse the diameter of a human eye before the eye disappears. So a human eye will still function. But the ship and all its contents, including the passenger, are totally invisible, and each passenger becomes a disembodied viewpoint falling between the stars.

Travel even faster, and a light beam may have time to touch the retina without first entering the lens of the eye. Now everything becomes a blur. On arrival the passenger becomes a psychiatric patient.

6) Interstellar dust would also be picked up en route. Most of it could be handled by a tough air-conditioning system; but a certain proportion would appear already inside the transitory space occupied by the passenger. Definitely he would need medical attention on arrival.

7) Interstellar hydrogen would be swept up by the moving ship. Aboard an end-teleport drive there would be absolutely no smoking. Drinking, yes . . .

8) As for meteors and larger bodies . . . we'll use a trick.

Let's say we're going toward that galactic core, i.e., toward Sagittarius. Okay. Before we leave the system, we take our ship to within a few million miles of the Sun, on the Sagittarius side; and we hover.

We hover by end-teleporting outward as the Sun's gravity draws us in ward. Half an hour of this should give us a respectable intrinsic velocity Sunward. *Now* we take off toward Sagittarius.

So we ram something enroute. It can happen.

But . . . it takes energy to make two solid masses occupy the same space. Chances are we *cannot* teleport *into* what we've rammed.

A fuse flows, and the motor stops. That leaves the ship with its intrinsic velocity, which we have built up hugely in a direction opposite to the direction of travel.

So the ship backs up at hundreds of miles per second! Even if we ram a *planet*, our intrinsic velocity is higher than escape velocity, and we're safe.

9) Conservation of energy rears its head once more. The ship becomes fiendishly cold as it leaves the solar system, and body temperature drops simultaneously.

The reverse occurs as we enter a system. It's a good thing we built a heavy air-conditioning system to get rid of all that dust. We'll need it for temperature control.

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Why do I persist in assuming that the conservation laws hold?

This question caused a series of soapbox speeches, mostly in my defense along the back wall of my Boston audience. The assumptions are important, and I'm going to try to justify them.

1) The behavior of the universe does not change. In all known cases the laws of conservation of energy and momentum hold rigorously. Now we use them for prediction. The existence and most of the properties of the neutrino were predicted by use of these and other conservation laws. Later the neutrino itself was detected through judicious use of its own proposed properties.

If today's physicists can use conservation to predict ghost particles, I can use them to predict the behavior of a teleport system.

2) In any case, I'm entitled to make any assumptions I like, if they are internally consistent. This is an exercise in speculation, remember? Speculation starts with assumptions. If you don't like mine, try your own; you might get interesting results.

3) A passenger teleporting downhill must lose potential energy. Some equivalent gain in energy must appear. But why heat?

Good question. I myself generally assume that the energy will appear as a jump in electron orbits. Then the electrons drop back, releasing photons. The photons are absorbed before they reach the passenger's skin, giving heat.

But almost any reasonable process will ultimately end in heat. Heat is the most general, most randomized form of energy.

Could the released energy appear as neutrinos? That would *not* give heat. But it would upset some of the obscure parity laws of nuclear physics (thus upsetting Isaac Asimov, Hal Clement, and thousands of reactionary physicists), and it would make uphill teleportation impossible, for the process would have to destroy neutrinos which weren't there in the first place.

How about a perpetual-motion machine?

See Figure V. The idea is to use open transmitter and receiver booths. The cargo, thirty gallons of water, is teleported to the receiver. It immediately pours out into the open transmitter, which teleports it back to the receiver, *et cetera*. Put a water wheel in the system, and we get power.

Obviously there's a flaw. If conservation holds, the water freezes pretty quick. Furthermore,

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Thermodynamics says that energy to run the system will be greater than the maximum energy to be obtained from the continuously falling water.

Let's replace the water with a ton of iron filings. That way we can close the whole system in a vacuum chamber and stop worrying about atmospheric friction, water evaporation and freezing of the water. We let the filings fall under gravity until the mass is a black stream, near absolute zero, moving at seven miles per second. That's nineteen minutes of operation.

Now let it go another nineteen minutes. The velocity doubles, and we've let the filings fall the equivalent of twice the distance from infinity to the Earth's surface.

We could maintain this acceleration forever, provided we do one thing. We will have to build our system at the North (or South) Pole. Otherwise the stream of filings will seem to bend away from the transmitter door as the Earth turns. (BOOM!) So we're at the North Pole . . .

In thirty days the mass of the filings has doubled.

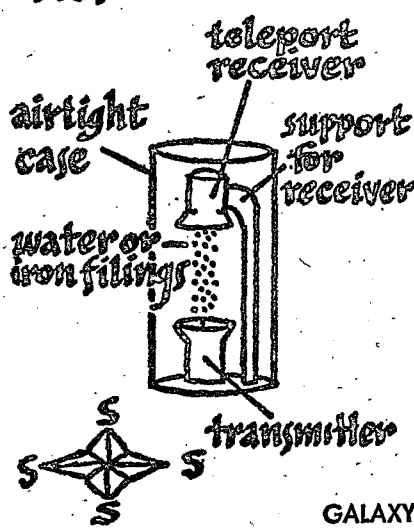
Note that while Earth pulls the filings, the filings pull the Earth. Minutely, at first. But the filings aren't really going anywhere, so we have the equivalent of a reactionless drive. Every month the thrust doubles. If we run the system long enough the filings will weigh as much as a star.

Obviously we don't want that. Tides! But in its present state, turning off the system would destroy the Earth. So we set up a second receiver at the South Pole. The stream of filings goes tearing off through the Earth's atmosphere, a blue flash of iron vapor ramming air. Even the gamma rays are going upward! What a show! Listen to that applause! But all the teevee cameras have melted . . .

Well, this is where I quit. But try a few postulates yourself, and see what you get.

—LARRY NIVEN

FIG. V



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GREEKS BRINGING KNEE-HIGH GIFTS

by BRIAN W. ALDISS

Love me, love my dinosaur!

The directors' meeting was over, and the men who really counted at Crosswell's fast fled from Old Man Crosswell's sombre presence and were preparing to jet home to various parts of Europe.

Milo Priedor said to Hans Gustoffen as they moved down the corridor, "Thanks for the support in there, Hans."

"It got tricky for a moment, eh? It's not just that we don't need Zadar Smith World to handle our publicity any more," Hans said, "but we got that creep Hicks fixed into the bargain."

"I rejoice! Not that I don't admire Hicks, in a way."

"Oh, I *like* the man well enough . . . "

They realized Carshalton Hicks was just behind and talked about the new live synthetic flowers both were growing in their offices.

Hicks took the scuttle to London, husbanding his wrath until he was in the presence of his third wife, Suomi, in their Kensington flat.

"They're crowding me again, scum like Priedor and Cox and Gustoffsen! They know I'll make managing director in two years and they throw all the dirt they can."

Suomi was very black and

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very voluptuous. The inside of her mouth was an attractive pink when she laughed.

"Turn the tables on them, as you have done before, my love-pie!"

"Know what they did? They got me to propose we shift our publicity account. They all wanted it! So I did it. Then they left me out on a limb. Then Priedor moved that they accept my suggestion and left it to me to break the news to Saul Betatrom."

She had been born in a kraal. Every item of her husband's manic world fascinated her. "Who's Saul Betatrom?"

"The Zadar Smith World guy handles all our advertising. I have to find him a parting present to soften the blow."

"Is that so hard?"

"What the devil do you give a guy like Betatrom? He already owns everything worth having."

Glimpse of pink again. "Give him something not worth having."

"Just what I want to do, darling — just so long as it *looks* like it was well meant! This is a ticklish consignment. It has to be something people will think he would go for but which he will hate like hell . . . "

"Leave it to me, love-pie. Your little Suomi will think of something. Meantime, how do you like my gown?"

She started the phasing process, pressing the button at her waist. Slowly, the glittering material of her dress began to turn transparent. Beneath the dress, she wore only one other garment. It also began to turn transparent.

"Yeah," said Saul Betatrom. Some days, like today he didn't think so fast. So he said "yeah" again to fill the vacuum. That free-fall orgy at Danny's place last night had about finished him.

The poisoned voice of Cox asked, "You get my meaning, Saul?"

Betatrom fiddled with the dial on his phone, trying to get Cox's face in better focus.

"You calling from Crosswell's, Sid?"

"Of course I damned ain't," Cox said. "I'll spell it out for you again, Saul. You're all sluiced out with the Crosswell account, but good. Priedor and young Hicks have worked a deal with Gum Inc."

"Gum couldn't advertise soap," Saul said, the name of the rival agency rousing him slightly.

"Gum just took over the publicity for Lawrence's Life-Forms," Cox reminded him. "Now there's an account that's going to escalate for decades. These new synthetic-life animals they got . . . "

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"Look, Sid, to hell with the natural history! Why didn't you speak up for Zadar Smith World at the meeting?"

"I was the only one who spoke for you, Saul, honest. I told the Old Man I was for you. I jeopardized my position."

Saul could see that happening.

"So they plan to hand me the golden armchair, eh?"

"Actual choice of gift is left to Carshalton Hicks, Saul. It may not be an armchair — "

Saul had switched off.

Mrs. Hicks — Suomi, the third and blackest Mrs. Hicks — leaned voluptuously across at Meconin and said, "You must enjoy handing big accounts."

Meconin scanned the sentence for double-meanings and said, "We are delighted to handle the Crosswell account." Meconin was the 'm' of Gum, the surviving, the triumphal initial; both 'u' and 'G' were back in the small-time where they belonged, whereas Meconin retired to his lunar estate every month, racing mechanical horses round the flood-lit craters. He was a white, fusible, neutral-looking man and wore, this evening, a tinkling inertia suit.

Hicks said to Meconin's mistress, Merita, "It's really cute, isn't it?"

She giggled. "Cute isn't the word!" She didn't attempt to say what was.

Hearing that the best way to please Meconin was to delight his mistress, Hicks had brought her one of the firm's tapeworms in an environment jar. The cestode, anchored in a transparent gut, had had its metabolism speeded up. It went through its life cycle every two minutes, ovoid segments falling from it like snowflakes, dissolving in suitable nutrients into eggs, which changed into embryos as a current wafted them into another section of the jar. The embryos became active crawly creatures, and finally emerged into larval phases. These little bladder-worms, suckled in more swishing juices, turned miraculously into small tapeworms, and the whole process began again. Merita could not take her pretty eyes off it.

"It's like an allegory of all life," Meconin said sententiously patting Merita's hand and then turning back to moist little Mrs Hicks. "You know, we also operate for Lawrence Life-Forms There's a revolution in our midst One of the great success stories of our times. They could probably make a synthetic tape worm that would be even safe in the human gut than Crosswell's are. Why, they are now

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through perfecting a miniature tyrannosaurus — that's a sort of savage little prehistoric dinosaur — the world's worst mammal ever — which we are going to launch in a month's time with a big multi-million dollar campaign."

"They sound dangerous," Suomi said, looking at him with her mouth prettily open.

"They only come knee-high, but they're dangerous right enough. I wouldn't want one."

"Well, guess we better get down to business. Mr. Meconin, since your time is valuable," Hicks said. He was too busy worrying about the way Meconin looked at his wife to notice the abstracted way his wife was looking into space.

It was two days later that Carshalton Hicks jetted over to New York to present Saul Betatrom with Crosswell Tapes' farewell gift to Zadar Smith World. Suomi stayed home, elegant in her new diamond chastity belt. Hicks wore a mask — the plague was bad in the poor parts of New York again and, although everything was said to be under control, he wanted to take no risks.

A couple of guys wheeled the large crate into Betatroms office. Betatrom was big this morning, dressed for the event, high-boots and larynx-amplifier and everything. He shook Hick's hand with a reinforced grip.

The youngest member of the Crosswell board of directors said, without removing his mask, "Mr. Betatrom, although no words can express the admiration my firm — and, I may add, myself — feels for the capable and inspired way in which you, throughout the past decade or more, have promoted — "

"Yeah, well, shag all that, Hicks," Saul said. "What you got in that crate?"

"This farewell gift comes from all of us — in which category I hasten to include myself — as a small — "

"Yeah, yeah, sure." His voice filled the room. Not that he believed current superstitions that hundred-decibel voices warded off the micro-organisms responsible for the plague, but it never hurt to play safe.

He crossed to the crate, grabbed the opener key, and wrenched.

" — very small, knee-high token — of how deeply we all feel . . . "

Hicks had taken the precaution of coming dressed in armored pants.

Scaly, ugly as a man in a mask, the tyrannosaur reared up on its hind legs, swished its tail, and jerked forward.

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Saul Betatrom jetted behind his desk, yelling.

Old Man Crosswell was laughing. The seemingly endless tears poured down his face. Across his desk from him sat Carshalton Hicks, face wreathed in smiles, at ease. Cox, Priedor, Gustoffen, stood by, puckering their faces into imitations of smirks.

"Goddamnit, Betatrom can't complain if the tryannosaur *eats* him!" Crosswell wheezed. "It's a real status symbol — the first tyrannosaur Life-Forms released, and by the end of the year everyone will want one. So from Zadar's angle his present looks real good — even if their New York boy loses a limb! Hicks, you done a good job! Thank God someone has a sense of humor round here."

He glared at the contorted faces of Cox and Co.

"Well, you boys! Old Saul won't be too too happy to receive this little something from another of Gum's big clients, will he? Specially if it eats him! What you say, Sid?"

Cox said, "It's not safe. I don't see it's so funny."

Sobering, the Old Man said dangerously, "Better ring him and tell him so, then, like you tell him everything going on here, eh?"

Priedor said hastily, "We all think Hicks did marvellously well, Mr. Crosswell. Betatrom had gotten to be a menace, and it's good to see his leg pulled — or maybe even eaten, like you say."

Just to infuriate Cox and Priedor, the Old Man got up, put his withered arm around Hick's shoulders, and began to laugh again.

And even if it wasn't so damned funny . . . he'd show his confounded doctor that a good laugh now and again never hurt anyone . . .

The lackey at the front door of Betatrom's Adirondack mansion stood respectfully aside as Betatrom paced through the hall — well aside. Betatrom wore lead levis.

He had his pet on a goad-leash which kept it away from his ankles.

The animal had just been fed with its morning Labrador puppy — a big Labrador kennel had been established on the estate just to keep the dinosaur in meat. It was docile enough in the mornings.

"This way, Suomi," Betatrom growled, dragging the creature down the north drive. Cowed, it did as it was told. Already, the truth had penetrated its pea-sized brain that Master was nasty when crossed.

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Master was nasty right now. Crosswell! They were at the root of all his troubles! Sure, he'd laughed off this pet easy enough, switched the tables on Hicks, turned the jibe into kudos for himself, got the press boys to phototape him with the critter on his lap, made himself the swinging fashion-leader, killed Gum's campaign dead (Gum had planned mink-collared tyrannos as ladies, adjuncts, and now Saully Boy had given them a reeking masculine image straight off!) . . . Then Morgan Zadar had shown.

Zadar was the kingpin of Zadar Smith World, perish his guts. Lean, ascetic . . . What the hell did ascetic mean, anyway? What he said went.

"I'll have to go to the funeral, Suomi," Betatrom muttered. "If Morgan says so." He sat down on a bench, dragged the dinosaur to him, pulled it up beside him. Suomi sat there, showing fangs and panting lightly.

It was humiliation. Sure, Zadar realized that. But, like Zadar said, they couldn't show how much they hated Crosswell's guts, or they would lose face. Old Man Crosswell had died laughing in his office — so Betatrom had to attend the funeral on behalf of Zadar.

He'd even have to shake the hand of the new managing director, and the hand of his scheming black wife.

Saul brightened.

"And I'll take you with me to the cremation, Suomi," he said. "You can scare the pants off your namesake. Maybe I'll starve you and let you run amok there."

But he would never dare do that.

He slumped again, lonely in his own vast estate. He patted the tyrannosaur's head, kissed her scales, slid a hand round her muscular neck.

"You're the only one who loves me," he whispered to her.

—BRIAN W. ALDISS

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GODEL NUMBERS

by J. W. SWANSON

Illustrated by GAUGHAN

A series of straight lines scratched on a stone might be a primitive ox-talley — or the key to all knowledge. What constitutes a universal language?

I

The incident that came to be associated with the Cairo stone, as it was later called, stemmed largely from the peculiar fact that its legal ownership was in dispute from the moment it was discovered. This, in turn, was due to the fact that the expedition which found this strange object was a joint archeological venture on the part of the Soviet Union and the United States. The name

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"Cairo stone," of course, is grossly misleading, since the piece of smooth black rock in question was actually found in the diggings of an old quarry site some 2000 miles west of Cairo. The joint expedition was, in a way, a by-product of the cold war. Or at least of the scientific and cultural exchanges between the Soviet Union and the United States that were designed to foster a *détente* between the two great powers. But whatever the ultimate origin or the causes leading up to the finding of the stone, the plain fact was that it was found by a team of American and Russian archeologists and that litigation over ownership of the stone began immediately at very high-diplomatic levels between the two countries.

The Cairo stone was a genuine archeological bomb shell. First off, there was never any question of its being a hoax, as is so often the case with inexplicable and totally unexpected discoveries of this sort. At the very instant the digger's pick first struck it, there must have been seven or eight American and Soviet scientists within 20 feet, with a French and Israeli archeologist thrown in to boot. To clinch matters, it was found some thirty feet down from the surface — thirty feet of digging that had taken place over some three months within the protective cocoon of the expedition's scientists. There was simply no possibility of a hoax, no way any one could have gotten that stone down there short of having placed it there some 5000 years ago; carbon 14 dating showed the stone to be at least that old. It had apparently been left, some time around 3000 B.C., at the site of an Egyptian stone quarry camp, the original and rather unexciting target of the expedition.

The Cairo stone would initially have aroused no emotions had it not been for the enigmatic character of the markings on its smooth surface. Clearly the markings were meant to record something, to encode some kind of information, be it no more than a talley of some sort — number of oxen used in a certain period, number of months passed by the overseers or engineers at the site, or what have you. So far, all right; nothing that would have attracted attention from outside a tight circle of scientists interested in just this sort of thing. But there was more. The markings on the stone, which consisted of nothing more than a number of lines of slanted strokes, had not been made by any of the usual methods characteristic of the third millennium B.C. and known to archeologists. That is, the slanted lines had not been chip-

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ped in by a chisel, dug in with an auger, or produced by any other sort of craftmanship available to Mediterranean civilizations of the year 3000 B.C. They were absolutely uniform in length, width and direction of slant. A photograph to cut away the edges of the stone and thus eliminate the three-dimensional effect, looked exactly like a page of slant lines typed by an electric typewriter—uniform, evenly spaced, absolutely regular.

The second peculiar thing about the Cairo Stone was its composition. It was thought at first that it was simply a natural piece of obsidian, perhaps worn smooth by natural processes, and simply used as a tablet by the person or persons who had written on it. But this proved wrong. The smooth black rock was not obsidian, although it had some of the properties of obsidian, which it resembled in many respects. Inexplicably, however, it defied classification. No geologist was able to pigeon-hole it as such and such a type of rock. Oh, I don't mean there was anything ultimately unknowable about it. Laboratory analysis revealed its chemical make-up easily enough — mostly silicon. It might very well have been a piece of meteorite. But the uniform texture of it gave the suggestion that it was an artifact, that it had been manufactured, not just discovered in nature. Certainly its original owner had not just found it lying about, as it were, on the floor of the Egyptian desert, unless it had been a meteorite. But even if a meteorite, there was still the peculiar homogeneity and the remarkably even top surface — the surface with the slant marks on it — to be accounted for. All in all, the Cairo stone just did not fit in with what we know of the technology and craftmanship of the Nile valley civilization of the third millennium before Christ.

II

My name is Matthew Hamilton, and I teach mathematical logic at State University. You are wondering how a logician came to be mixed up with a piece of stone covered with some strange and baffling markings. That's easy enough to answer. The head of the American component of the joint expedition that had discovered the Cairo stone is a distinguished archeologist from State University. And in addition to being an archeologist and distinguished, he is tough. Largely due to his stubborn efforts, the stone was brought back, pending the result of the high level Soviet-American negotiations, to State University. It was promptly locked up in the

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laboratory of the head of the department of geophysics, Isodore Wolfe, who was to conduct the chemical and spectroscopic tests to determine its molecular structure. Now it turns out that Isidore Wolfe is one of my closest friends, all of which is by way of explanation of my involvement with the Cairo stone.

The stone had been found in March of this year, and now, by midsummer, after some peregrinations to the Smithsonian and elsewhere, had finally been bedded in Isi's laboratory. That had been sometime in April. The events that I am going to tell about began sometime in the middle of July. It had been an excessively hot day, and as I had nothing pressing to do — I never teach in the summer unless my department-head virtually orders me to do so — I had spent the morning looking through a very elegant new version of Cohen's proof of the independence of the axiom of choice, sent to me in manuscript version by a colleague at Rice University, and in the afternoon I had worked on a variant of Turing machines that I had been tinkering with the last couple of weeks, a variant in which state symbols are eliminated in favor of print instructions, and change of direction instructions eliminated altogether by means of a circular tape. But it was mostly a half-hearted effort in the shimmering of un-air-conditioned heat of the tiny cubicle that I call my office, and I had not been able to prove the result I had been trying for. Still, it was absorbing work, and the hours somehow slipped by until I was surprised to hear the clock on the old chapel building ring out nine p.m. At just about that time I heard a knock at my door, and Isidore Wolfe unceremoniously ushered himself in without waiting for a reply.

"Still trying for the big result in effective computability," he said, picking up and laying down one of the symbol-filled scratch sheets of paper on my desk.

"Big result!" I flung back in mock anger. "My last thrilling theorem was the big result of the second half of the century. What do you expect from me? Two strokes of genius in one lifetime?" Actually, my last theorem had been only a modest addition to the theory of effective computability, but the proof was rather intricate and original, and I was inordinately proud of it. I always pretended to Isi that I was the Godel of the second half of the twentieth century. Keep that in mind. It will come up again later.

Isi settled down with a cigar, and I lighted my pipe, and we

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proceeded thoroughly to pollute the atmosphere of my tiny office. We talked idly to no great purpose, for it was summer and hot and lazy-like — but getting bearable now that the sun had gone down — and we both felt relaxed and ready for gossip and light badinage. Isi talked first, about the current in-fighting and jockeying for position in his own department and blasted off steam at a couple of his colleagues with some juicy epithets — Yiddish and English. I let him go on until he felt better. After a while he turned to his latest efforts to analyze the composition of the Cairo stone — they had not revealed much beyond the fact that the crystal structure of the material comprising the stone was one the geologists and physicists who were working with it had never run across before, except when produced under artificial laboratory conditions of enormous pressure and temperature. Again, it appeared that the stone was something of an artifact, not a natural piece of rock. But if it took huge pressure chambers and modern ovens to produce that sort of crystalline structure in 1968, how the devil did it get produced in 3000 B.C.? Neither Isi nor I could offer an adequate hypothesis regarding the origin of the stone, much less of the peculiarly uniform markings on it. We had just turned to the subject of the markings when somebody tapped on the door.

It was our mutual friend, Chester Wu, of the Computer Science department. He wedged his way into the office, sat down on the sole remaining chair, and went through an exaggerated imitation of a man choking to death on poison gas. So we left the door open in order to clear out some of the pipe and cigar smoke, and we continued our desultory but nonetheless enjoyable conversation, with Chester joining in.

Let me admit right here that Chester, Isi and I make up a strangely assorted trio. I suppose the fact that we are all three unmarried has something to do with our being close friends. Isi was divorced, and Chester and I had never got beyond the affair stage. At any rate, we spent a good number of our leisure hours together — playing chess, listening to chamber music live or canned, cooking up elaborate Italian dinners in one of our apartments, but mostly talking. Our backgrounds were widely diverse, so much so that we were almost always a source of novelty to one another — a factor which no doubt contributed to our friendship.

Isidore Wolfe was a New Yorker, a Jew, and a product of

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big city schools — B.A. from what was then City College, Ph. D. from Columbia. He was in his early forties, fairly recently divorced, no children. His five-year marriage was a never-ending source of hilariously funny stories with which he kept Chester and me constantly in stitches. Although he had been profoundly incompatible with his wife, I gathered that his marriage had been a rather exciting sort of thing, in the sense that one big five-year-long fight could hardly be dull.

But he was much better off out of it and knew it. In fact, it seemed that he was always just realizing how fortunate he was to be free, and enjoying the ecstasy of relief, as it were, for the first time.

Chester Wu was only a youngster, in his mid-twenties, having just completed his Ph. D. at the California Institute of Technology, after a B.A. at U.C.L.A. He was an Assistant Professor in the department of Computer Science, and quite possibly the most brilliant young faculty member at State University. His parents were both Chinese Americans, and although he was fluent in Chinese, he was thoroughly Americanized and spoke colloquial English without the trace of an accent. If you want a good picture of how Chester looked and acted, just think of Jimmy Chan — Number One Son — in the old Charlie Chan movies. Chester was conscious of this resemblance, and it amused him no end. He even went so far as to interpolate pseudo-Chinese proverbs into his conversation, proverbs which he claimed to have learned from his "father," Inspector Chan. He and I shared a number of interests in common, there being no small overlap between mathematical logic and computer science. We were both interested in recursive function theory, information theory, set theory (in a dilettantish way), and artificial intelligence — not to mention a common interest in the great S. S. Van Dine mystery stories with that remarkable fictional detective, Philo Vance.

As for myself, there is less to say, and nothing at all exotic to relate. I am a typical Wasp, an Associate Professor of Philosophy at State, and a product of decent undergraduate training in mathematics at Indiana, topped with an Ivy League Ph.D. in philosophy, most all my work having been in mathematical logic. I do teach two fairly esoteric and technical graduate seminars in philosopry, however, one in philosophy of language, the other in the philosophy of science.

But so much about our backgrounds.

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"One thing for sure," Isi said, sticking out a dogmatic neck. "There can't be much of importance in any language that you can get by writing down a bunch of slant marks over and over again. That might be a good way for the felahin to count their wives or sheep, but it sure as hell won't serve for anything more sophisticated."

This wasn't entirely true, and Chester and I brought the axe down on Isi. It is a truism of Information Theory that the amount of information transcribed in any form is a function of prior knowledge on the part of the recipient of the information, and not solely of the medium in which the information is transcribed. Thus, if you have previously memorized the Encyclopedia Brittanica, a very simple message from me to you, consisting of a volume and a page number, will quite possibly suffice to convey an enormous amount of information. "And if there aren't any prior conventions agreed upon between sender and receiver," Chester concluded this argument, "then there can't be any message sent. Not that sender and receiver actually have to get together beforehand and agree on the conventions. The receiver can even attempt to deduce the conventions from the message, then retroactively agree to them, reading back into the coded message. But there must be a set of conventions, some set or other, on which the code is based."

"And that's what we would be doing if we assumed the marks on the stone were a record, or tally, say, of the number of oxen used on successive months in the stone quarry," I joined in.

"Which is probably just the sort of thing that the jerks who wrote on the stone had in mind," Isi added dourly.

The conversation continued in this vein for perhaps half an hour longer. For some reason, we could not seem to get our minds off the topic of the Cairo stone. In some unexplained way, it seemed to all three of us that there was something unnatural, something terribly incongruous about the stone, and in particular about the fact that it did not fit into any rational explanation that we might try to offer. Fantastic thoughts unspoken by any of us, lurked in the background of our conversation — thoughts about the evidence for the existence of an intelligence incommensurate with anything contemporary history knew about the Egypt of five thousand years ago.

A lull came over the conversation to be broken by Chester.

"Good Lord! Do you know that neither Matty nor I have ever

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seen this flipping rock. Here we are beating our gums about something that we have never laid eyes on, but which is only a five-minute walk from where we are sitting."

"Let's go," said Isi, getting up with unexpected vigor. "I have my lab key with me. You guys can look at it as long as you want, and maybe you'll be able to tell me how the damned thing was made."

It was cooler as we stepped out of the office building, and a fresh breeze had sprung up to make the summer night quite agreeable. It was early yet, no later than ten o'clock, and there was still quite a bit of activity and bustle on the campus, especially student couples walking together slowly, hand in hand, absorbed and lost in one another. We took our time strolling past the pond, past the student union and between the Chemistry building, identifiable by the characteristic odors emanating from it, and the theatre building, where some sort of rehearsal was going on. After about five minutes we came to the massive new geophysics tower where Isi had his office and his laboratory. The building — it was called the Willard Gibbs Geophysical Laboratories — belonged to the genre of the new architecture — all glass, no ivy. I like that kind of building for physics laboratories, theatre centers, and behavioral science buildings, but I am old-fashioned enough to prefer the humanities to be lodged in old, high-ceilinged, red brick, ivy-covered buildings. The humanities need a certain mustiness in order to feel comfortable.

Isi unlocked the building door, and we stepped into the entrance hall where a myriad of glass cases, containing various exhibits of minerals, meteorites, soil samples, etc., were on display along the walls. There was still some activity in the building, with lights on in a number of offices and laboratories.

Since authorized personnel all had their own building and laboratory keys, work continued around the clock in this and the other science buildings on the campus. I suppose this is the usual sort of thing everywhere science is done; experiments just don't terminate themselves at 5:00 p.m. on week days.

III

We took the elevator up to the third floor, where Isi's laboratory was located. The building was air-conditioned — one of the few air-conditioned refuges on our campus — and felt almost cold by comparison with the air outside. On leaving the elevator

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we followed a wide corridor straight in front of us, on both sides of which were doors to laboratories. About midway down the corridor we halted, and Isi started to put his key in the lock of the door to laboratory 314, his own private laboratory, then suddenly stopped. We could distinctly hear voices coming from the other side of the door. Isi turned to us quizzically, his head cocked expectantly to one side, and his finger on his lips admonishing us to remain quiet. We listened motionlessly, our heads inclined toward the door.

"I think I hear a woman and two men," Chester whispered after about two minutes of almost breathless silence on our part. I confirmed this by nodding. Clearly one of the voices was that of a woman, while the others — it sounded like two — were men's voices. One was deep, mellifluous, and resonant; the other was also a baritone, deeper than the average, but not pitched quite so low as the dominant male voice.

"Well, damn it, this can't go go on forever," Isi said with determination, unlocking the door and pushing it open in one quick motion. Chester, Isi, and I all entered the laboratory in a concerted movement and drew up still just inside the door. The three persons already in the room — two men and a very young woman, as we had divined from the sound of their voices — stopped their conversation abruptly, and stood awkwardly at the laboratory bench near which they had been standing when we entered. A drawer in the bench was open, and a smooth black object, about the size and roughly the shape of a large encyclopedia, was clearly visible in the drawer. I knew, almost intuitively, that what the intruders had been looking at was the Cairo stone.

Two of the unexpected guests in the laboratory were known to all three of us, and the third, it turned out later, to one of us. One of the men, a heavy-set and very handsome chap with completely silver hair, worn long and combed straight back from his forehead, was immediately recognized by all of us as Anton Pokrovskoe, the eminent Russian anthropologist who had headed the Soviet contingent of the joint American-Russian expedition that had turned up the Cairo stone. The young lady we also recognized as Rebecca Hale, Isi's laboratory assistant and a Ph. D. candidate in geophysics. She was visibly and painfully embarrassed, having turned about *n* degrees whiter upon our entrance. Not so Pokrovskoe.

"It is so good to see you again, Dr. Wolfe," he said, iden-

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tifying himself as the resonant bass voice that we had heard from the other side of the door. "Please forgive us if we seem to be intruding, but Miss Hale, who has been our so gracious hostess this evening, asured us that you had finished your work in the laboratory for today, and that we would not be intruding. Ah yes, Professor Hamilton, it is good to see you again as well." I nodded my head in acknowledgment of the greeting — I had met Pokrovskoe briefly at a reception in honor of the joint expedition on the occasion of the return of the American scientists to State University — and turned to see what Isi would say and do.

He had not lost his aplomb in what was an obviously embarrassing situation for all of us, but advanced calmly and shook the Russian's proffered hand as if the situation were the most natural in all possible worlds. He then introduced Chester to the Russian anthropologist, whom he knew by sight but had never met. Pokrovskoe in turn introduced the other man to us.

"Please allow me to present to you Mr. Nicholas Kurlov, attaché to the Russian embassy in Washington. He is an old and good friend of my family, and he is visiting us before returning shortly to our country." Pokrovskoe's voice was not only mellifluous, it was oily and insincere as well.

Kurlov shook hands formally with the three of us, hesitating briefly as he was introduced to Chester, as if he knew him. Chester, who had spent a post-doctoral year at Dubna, studying and working with the giant computer recently installed there for the Joint Institute for Nuclear Research, mumbled something in Russian to Kurlov that neither Isi nor I understood. It was, to say the least, a fantastically awkward situation. But the two Russians, overdressed as Russians seem to be to Americans — incredibly they both wore dark wool suits, shirts and ties in the middle of summer — played out the game as if nothing out of the way had happened, while the hapless Miss Hale agonized speechlessly without having once moved from the spot where we first saw her upon entering the laboratory.

What had happened was obvious, of course. The two Russians, distinguished and exuding prestige, had overwhelmed the impressionable little Rebecca Hale into allowing them to accompany her to Isi's laboratory. She was authorized to be there, to be sure, and had building and laboratory keys that allowed her access at any time. But for a laboratory assistant to allow unauthorized personnel access to the

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department chairman's laboratory, regardless of how silver-haired and eminent they might be, was sufficient reason for dismissal. And she knew it.

The awkward situation did not last long, however, for after some amenities and another round of handshakes, European style, the two Russians departed as if nothing irregular had occurred. Isi took the now trembling Miss Hale aside for a few words, after which she left the laboratory stiffly and white-faced, looking like a zombie.

"I chewed her out good and proper," Isi pronounced with menace once the three of us were alone again. "I'll let her stew in her own juices for a couple of days before I tell her that I won't press disciplinary action." Isi talked tough, but at heart was as gentle as they come. "But damn it all, I don't like this. She told me that they had been here about half an hour. During that time, Pokrovskoe just happened to remember that he had left his attache case on the seat of the car in which they had come, and that it contained valuable papers, and that the car was unlocked, and would you, please, Miss Hale, be so very good as to return to the car and lock it. That must have given Pokrovskoe and Kurlov at least ten minutes alone in my lab. By the way, did you smell their breaths? The Vodka vapor they exhaled nearly gave me a jag. Including my faithful Rebecca. That was part of their non-sexual seduction of the poor dumb child."

When Isi had finished speaking, we suddenly remembered that our original purpose of coming to the laboratory was to see the Cairo stone. And there it was. Isi picked it out of the drawer and carefully laid it on the laboratory bench, where the light was better. The stone was smooth on its surface, save for the inscriptions, roughly rectangular in shape but with rounded edges, uniformly black — the darkest black, I believe, that I have ever seen — and weighed about four pounds. The inscriptions on the surface consisted of nine rows of slanted lines of absolutely uniform length, the rows varying however with respect to the number of lines they contained. Two of the rows were indented an even space, about half an inch, almost exactly like the indentation for a paragraph on a printed page. The effect the stone had on me was singular. Knowing it had been found among other artifacts in an excavation that bore the date 3000 B.C., I could not overcome the impression that it was in some way alien to everything that recorded history has told us.

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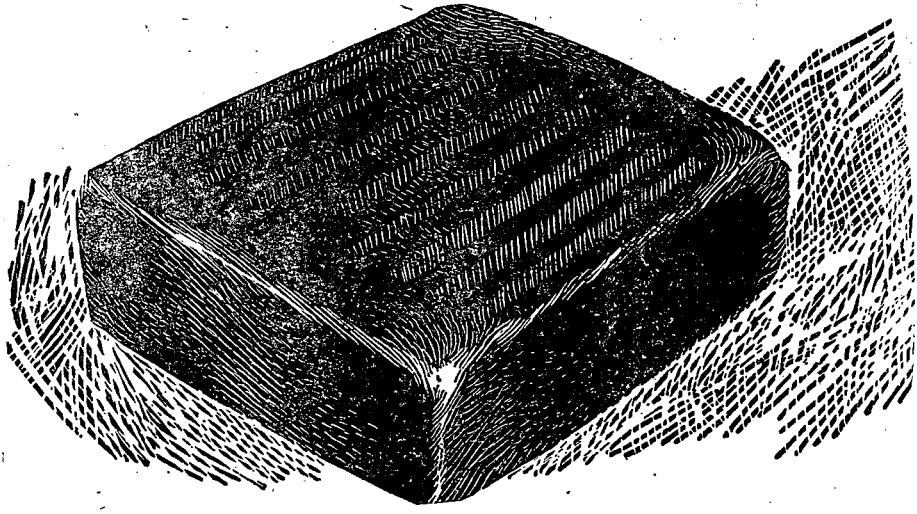
"What's on the bottom side?" Chester asked.

"Nothing," Isi replied. "It's just like this side, but without the inscriptions. Smooth, except for a little piece we drilled out for analysis. Here, I'll turn it over and show you."

The opposite side of the Cairo stone was not uniformly smooth. Almost so, but not quite; there was a small chip in the bottom right hand corner of it. Otherwise, the surface was as flat and uniform as the top side. But something was wrong. Isi was visibly perturbed.

"That wasn't there this morning, goddamn it. Not that size, anyway," Isi growled. "We had taken out a little piece, about a cubic inch, in just that spot, for chemical and spectroscopic analysis. But the hole is bigger now, by twice the size. And what has been taken out was not drilled out, but crudely chipped out with what must have been a small geologist's pick. It was Pokrovskoe and Kurlov; I know it. I feel like calling Washington and having those two sneak thieves kicked out of the country."

"It wouldn't do any good," I interrupted in what I thought was a soothing voice. "Besides, you can scarcely prove anything. *You* know that the hole is slightly larger than it was, but that's



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hardly firm evidence. And don't forget that during the day there are a lot of people working with you in this laboratory, and you occasionally step out for coffee. There is no use flying off half-cocked calling people in Washington. Come on, let's get out of here and have a drink."

This suggestion met a warm response, and a half an hour later we were settled down with martinis in a cool lounge — one of the three, and the only decent one to be found in the small, almost rural little town where State University is located. The martinis before us constituted a second round — we had tossed the first one off quickly — and Isi had cooled off a bit, although he was still pretty hot under the collar about the invasion of his laboratory and the theft of a piece of the stone.

Remembering now that Chester had said something to Kurlov in Russian, I asked him what it had been.

"I told him I was glad to see him again," Chester replied, obviously relishing the fact that he had some information up his sleeve we did not know about.

"Then you have met that damn attaché before," Isi exploded in a tone that suggested that more acquaintance with Kurlov on Chester's part implied guilt by association of some sort.

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"Attaché, schmattaché," Chester returned wryly, with a Wolfe-like imitative shrug of his shoulders. Chester had the Clever habit of picking up Isi's Yiddish interpolations, and this sort of expression — so utterly incongruous coming from a young Chinese-American — was ordinarily a source of much hilarity to Isi. But at the moment he was in no mood for laughter.

"What the devil do you mean, Chester?"

"I mean that Kurlov is no attaché to the Russian embassy in Washington. I knew him at the Institute at Dubna. He is one of the top-notch Soviet computer scientists. It was he who was in charge of the installation of their big new computer there. And what he is doing in this country, I don't know. Earlier this week a colleague in my department who had just flown back from Dubna told me that he had seen Kurlov there. So he has just freshly arrived in the States, of that we can be sure."

"But why did Pokrovskoe lie to us, and introduce Kurlov as an attaché" I mused more to myself than to the others.

"Maybe to cover up the fact — I guess it is a fact — that he flew over to this country on short notice just to see the Cairo stone," Chester replied. "But why should a computer expert want to look at an old rock? One thing for sure, we need some more nourishment to figure this thing out." And he held up three fingers to the waiter to indicate another round of martinis.

"Pokrovskoe or any other damned amateur could have hacked out that chip from the stone," Isi said as the bartender brought three fresh drinks. "You certainly don't need a computer specialist for a schoolboy trick like that. Well, they have a piece of the stone now, and that's that. They might as well have the whole damn thing, since x-ray analysis indicates the material in the stone is homogeneous. If you know what a piece of it is made of and how it was made, you know about the stone."

"All there is," Chester echoed. And I could see that there was something troubling him — something that was perhaps buried below the surface of his mind. Later we were to learn that what was at the back of Chester's mind at that moment would turn out to be the solution to the enigma of the Cairo stone.

IV

A week later found the explanation of the anomalies concerning the Cairo stone little advanced. Isi and his associates were continuing their analyses, but

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with little evident progress. The mystery of the nature of the stone had even grown more complex, if anything; for chemical analysis had shown that it had some rather remarkable properties not hitherto suspected. Among them was the stone's ability to withstand the corrosive effects of the most powerful acids known to contemporary science. It was as if the stone had actually been designed to last for untold centuries — forever, even — once it was abandoned to the state of nature. Isi estimated that it was well-nigh indestructible and could endure the eroding effects of the elements not merely for hundreds and thousands, but for millions of years — or at least as long as the earth endured. Proof of design? The evidence was becoming more compelling with every passing day.

As a special precaution against a repetition of the intrusion by Kurlov and Pokrovskoe, a special lock had been installed on the door of Isi's laboratory and a pair of night watchmen armed with revolvers had been assigned in shifts to remain in the laboratory from the time it was locked up in the late afternoon until Isi arrived to begin work early the next morning.

As I said, an uneventful week had slipped by, and another hot July evening found Chester, Isi and myself assembled in Chester's office in the Computer Science building. This, like the geophysics building, was one of the new structures on the compus; and housing the Control Data 3600 as it did, it had to be air-conditioned. Human beings and faculty members can endure the sweltering summer without comfort at public universities, but not expensive giant computers. We were quite comfortable, relaxed and generally in an expansive mood after a satisfying dinner at Mario's, a new Italian restaurant that had opened off of the main highway to the capitol, not too far from the campus. Moreover, we were enjoying the pleasant anticipation of a rather important occasion; we were among those invited to a cocktail party at nine o'clock at the Faculty Club in honor of the people connected with the joint expedition that had unearthed the Cairo stone. The earlier affair, where I had originally met Pokrovskoe, had been a drab little thing of sherry, cheese and crackers, organized by the anthropology department. But this would be the big one. The host would be Dean Ortcutt of the College of Arts and Sciences. Pokrovskoe would be there, of course, as one of the honorees, and most surely protocol would include his guest Kurlov among the invited. It was only eight-

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thirty, so we had half an hour or so to kill before starting over to the Faculty Club where the affair was to be held. We had finished swapping opinions on the character of the two Russians — negative for Pokrovskoe and positive for Kurlov — and the conversation had trailed off. It was at this point that I blurted out what had been on all our minds, unspoken and perhaps just below the conscious threshold for the last week.

"Look," I said, "let's be frank with ourselves and say aloud what we have all been more or less thinking. That damned piece of black rock is the product of high technology, of an intelligence or civilization that could not have existed at the time the forefathers of the *fellahin* were quarrying granite in the desert outside of Cairo." I looked to Isi for confirmation, for I knew intuitively that he felt as I did.

"That's right, more than right," he nodded. "The stone is definitely an artifact, and I'm not referring just to those crazy marks on it. I mean the substance of the stone itself. It is definitely not a mineral made in some kind of kiln, under fantastic conditions of heat and pressure. It resists the action of the most powerful acids and solvents that we can apply to it. And here's the clincher. I am beginning to doubt whether *we* have the technology, as of July 1968, to synthesize that sort of material ourselves."

"But further analysis of the stone might reveal something about the technology responsible for producing it, don't you think, Isi?" Chester asked.

"Yes, most certainly. And that is what disturbs me about the Russians getting hold of a piece of the stone," Isi replied. "It's beginning to appear that this presumably inoffensive archeological discovery could have locked into it information concerning a kind of technology advanced far beyond our own. Slowly but surely laboratory analysis will unseal that information. And the impact on science as we know it could be enormous."

"Information," Chester murmured almost to himself. "It's the information."

Something was still bothering Chester — that idea that had occurred to him at the lounge had apparently not stopped gnawing at the back of his mind. But he volunteered nothing further, and we let the subject of the Cairo stone lapse. After a few minutes devoted to the pennant hopes of the Red Sox — dismal, we concluded — we noticed that it was after nine o'clock and left Chester's office for the Faculty Club. It was only a seven-minute

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walk from the Computer Science Center, so we scarcely had time to get rumpled in the heat before entering the sanctuary of air-conditioning again. Incidentally, in case it sounds from what I have been saying as if State University is comfortable in the summer, let me assure you that I have exhausted the inventory of air-conditioned buildings on the campus.

Everybody who was anybody was at the reception, or cocktail party, or whatever you want to call it — the President of the University in all his dignity, the Provost, various Deans, Department Heads, distinguished Egyptologists, anthropologists and what have you, both from State and from other institutions, some of them sufficiently far away to involve an over-night stopover. Big time! It was a real bash, all right. The spirits were flowing from a well-stocked bar behind which three barmen—actually they were graduate students in white jackets, picking up a little cash — were industriously popping corks, shaking mixers, and pouring very professional looking libations. There were several tables laden with hors-d'oeuvres, including caviar — but only domestic — in honor, no doubt, of Pokrovskoe and the other Soviet members of the Cairo stone expedition. Indeed, we immediately spotted the Russian scientist, glass in hand and his colleague Kurlov at his side, before the largest of the tables of food. There were three other men with him, quite Slavic looking, younger than either Pokrovskoe or Kurlov, and obviously not academic types. One of them had a small but noticeable scar over his left eye. We had seen none of them before, and, knowing the Soviet members of the expedition at least by sight, we were able to exclude that explanation for their presence. Although I hate to say it — it sounds so "gothically" melodramatic — there appeared to be something sinister about those three unsmiling and strange faces. But our attention was soon enough diverted from them, as Dean Ortcutt made his way through the throng and welcomed Isi, who had twisted the good Dean's arm to get invitations for Chester and myself to the reception. Isi, as prestigious head of one of the most important departments at the University, was part of its power structure, to use the current jargon of the civil rights movement. Chester and I, although respected for our scholarship, definitely were not.

The Dean steered us over to the bar, where Isi and I settled for our usual martinis, and Chester experimented with a

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stinger. While Isi and Ortcutt immersed themselves in a discussion of campus politics — most of which, incidentally, is carried on at informal meetings of this sort— Chester and I wormed our way through the press of bodies and elbows to the table of hors-d'oeuvres where, upon entering, we had seen Pokrovskoe. He was still there, with Kurlov and the three unsavory looking ones. They were all speaking Russian, which confirmed our assumption that the three newcomers were countrymen of the two Soviet scientists. Chester and I helped ourselves to the tempting canapes. It was Kurlov, and not Pokrovskoe, who noticed us first.

"My good Professor Wu," he said with genuine warmth, "it is my good fortune to see you again. I have cordial greetings for you in recent letters from my colleagues of the Institute at Dubna. They remember well, and with pleasure, your sabbatical year with us." It was obvious that he was no longer trying to pass himself off as an embassy attaché. It would have been useless, anyway since Chester recognized him.

Pokrovskoe now turned to us and greeted us with elaborate cordiality, but not with evident sincerity with which Kurlov had met Chester. After the usual amenities, during which he did not introduce us to his three identical looking comrades — they hovered awkwardly in the background, just a few steps away from their countrymen — Pokrovskoe turned to the subject of the Cairo stone. There is real *chutzpah*, I thought to myself; he should show some scintilla of embarrassment regarding that subject, in view of having been caught red-handed in the middle of the crime in Isi's laboratory a week ago.

"And Dr. Wolfe's analyses, they are progressing well? He has been able to classify our strange little, ah, mineral deposit from the quarry of Egypt?"

It was obvious that Pokrovskoe was pretending to know nothing of the composition of the stone, so I uttered something noncommittal and turned the subject to another topic, a comparison of July weather here and in Moscow, I believe. But while conversing with Pokrovskoe in this trivial vein, I kept my ears open to the more animated conversation at my side between Kurlov and Chester.

Kurlov was asking Chester what he thought the origin of the stone might be. But he wasn't pumping Chester, as Pokrovskoe had tried to do with me. In fact, he was revealing to Chester a considerable knowledge of the stone's composition. The labora-

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tories at Dubna must have been working on twelve-four-hour shifts during the last week to have provided him with as much information as he had. He was aware of the stone's anti-corrosive properties, and of its ability to withstand extremes of temperature.

He spoke eagerly, openly and frankly and attempted to conceal nothing. Clearly the scientist had come to the ascendancy in Kurlov's personality, and the conspirator had receded to the background. Moreover, his previous acquaintance with the affable and boyish Chester was obviously a factor in unlocking his tongue. Pokrovskoe, who spoke English well enough but obviously *thought* in Russian, was not able to follow the adjacent conversation as I was.

Besides,, I was talking all the louder, faster, and slangier to keep him preoccupied.

"Yes, yes, yes, the slant line markings," I overheard Kurlov say excitedly. "What do you make of them, Professor Wu? They intrigue me, you know. For some reason, I cannot now tell you why, I cannot regard them as trivial in the way Professor Wolfe has suggested. There is a certain regularity about them—although I have only seen them the one time in the Professor's laboratory that evening that we so rudely imposed on the kindness of Miss Hale — a certain regularity that suggests they represent something more than just a talley of oxen. Now tell me, my friend, what do you think?"

Chester replied that he had been studying a photograph of the stone in his office that very morning in an effort to deduce something from the nature of the markings, but that nothing had suggested itself. "And the message, whatever it is that is encoded by the slanted lines," he concluded, "can't be too consequential. There is just not enough there to say anything significant. At least, that is the most obvious conclusion to draw. Unless . . ." Here he trailed off, looking vacuously at the bottom of his now empty glass. Again I had the uncanny feeling — call it a premonition if you will — that Chester was on the verge of an important insight into the nature of the Cairo stone.

But abruptly he and Kurlov broke away from us at this point to wander over to the bar to refill their glasses. As they were leaving, I heard Kurlov ask Chester if he might look at the photograph of the markings that Chester kept in his office. I took the opportunity offered by a lull in my conversation with Pokrovskoe to excuse myself and went off in search of Isi.

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V

I found him at one of the smaller canapé tables, spearing tempting pink shrimp from an iced bowl with a tooth-pick. I told him of my conversation with Pokrovskoe and sketched out the one I had heard between Chester and Kurlov. When I repeated what Chester had said about having looked at a photograph of the markings earlier in the day, a look of concern passed over Isi's face.

"Matty, did Chester tell Kurlov where he kept the photograph?"

"He just said that he had been looking at it in his office," I replied. "And Kurlov asked to see it some time."

"Goddamn it, that's not good. Do you know, Matty, that no photographs were taken of the stone before I got it into my laboratory, and that I didn't allow any to be taken after that time?" By some extraordinary oversight, the Soviets had not obtained photographs of the stone before it got out of their hands. Not so extraordinary, I guess, if you reflect that the expedition at the quarry site had no need for camera equipment, and that the stone was flown by military jet directly from Egypt to the United States.

"And if Kurlov wants to see that photograph, that means either they overlooked taking shots of it when they got into your laboratory, or else we interrupted them just as they were about to do so," I said. "Probably the latter. They could have got rid of Rebecca Hale again under some pretext or other, in order to take pictures."

"Yes," Isi replied, now quite excited. "And Kurlov has by this time told Pokrovskoe about the photo in Chester's office. There they are together at the big canapé table, and Pokrovskoe looks as if he were going to take off into orbit. Let's get out of here, Matty."

We bulled our way through the swarm of people standing around talking and drinking and made our way to the door of the room. On the way I caught sight of Chester, made a brief broken field detour, in which I caused quite a number of glasses to slosh over, and plucked him away by the arm from a flirtatious conversation he was enjoying with somebody's young wife, to rejoin Isi just as he was opening the door leading out of the reception hall. The foyer outside was unencumbered of people, and we burst out from it into the starlit summer night with a common feeling of impending climax.

Sharing a sense of urgency that we knew intuitively there was no

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need to communicate to one another, we broke into a trot across the campus. The Computer Science Center, located on sloping ground slightly higher than that of the Faculty Club, was clearly visible to us, lights still glittering from a half dozen office windows, as we raced past the pond, the administration building, and the student union. It must have taken us only about three minutes from the time we left the Faculty Club to reach Chester's office. We burst into it, Chester leading the way. He literally flung himself at the file cabinet next to the window, jerked open the second drawer from the top, rummaged furiously for a moment, spun around triumphantly with the photograph of the Cairo stone in his hand.

"Baby, you are going to go home tonight with Papa Wu's number three son," he chuckled. And with that we settled down in chairs to catch our breath and collect our wits after our little sprint across the campus. We were winded in direct proportion to our ages: Isi was virtually knocked out, I was huffing and puffing moderately — but not too moderately — and Chester seemed scarcely affected by the exertion. Isi produced three of the strong, black Brazilian cigars —Rigolettos, they are called— that he was fond of, and we lit up in contentment and self-satisfaction. We had learned something at the reception, something that might turn out to be quite significant. The Soviets had a piece of the Cairo stone all right, and we knew from Chester's conversation with Kurlov that they were progressing along the same lines that Isi had followed in his laboratory analysis of the composition of the stone. But through negligence on their part, and some extraordinary good luck on ours, they had failed to photograph, and presumably to record in any way, the curious markings on the stone. What was more important, Kurlov was now interested — more than interested, I should say — in those slanted lines. It was beginning to dawn on us that Kurlov's interest in the inscriptions, as opposed to the substance of the stone itself,, might have tremendous significance.

"But why should Kurlov be interested in a few unexplained scratches on that damned crazy rock?" Isi inquired plaintively.

"Right," I joined in. "After all, he's a computer scientist, not an archeologist. His bag — "I sometimes like to pretend that student slang comes naturally to me. "— is information theory, automation theory, machine theory, the same sort of thing Chester here does. Same kind of interests, right?"

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"Yeh, that's for sure," Chester replied. "He has no interest in archeology or anthropology, I know from my year at Dubna. He's a pure theoretician, through and through. About the most practical thing he can do is play chess."

"Well, let's be logical about this," I said. "If he is primarily interested, not in the chemical analysis of the stone, but in those cryptic little lines, then he is interested in them from the point of view of the computer scientist and information theorist, right?"

"Agreed," Isi joined in. "But that in turn implies that he does not regard them as oxen-counting notches — that he in some way thinks they encode information, a message if you will, of much greater significance. Yet frankly, that seems impossible to me. If the lines varied in shape or size, they might be construed as an alphabet. But as it is, they represent nothing more than numbers of notches. Surely it's more logical to think of them as tallys for . . . "

"Numbers," Chester said dreamily. He was looking towards the ceiling in complete abstraction, immersed in his own thoughts, the half-smoked cigar that Isi had given him clenched between his teeth. The expression in his eyes was that same perplexed but on-the-verge-of-understanding look that I had seen twice before when Chester had been thinking about the strange inscriptions on the stone.

"Yes, numbers," Isi replied a little irritably. "And just plain old-fashioned numbers can't tell you anything."

"Numbers can't tell you anything?" Chester echoed absently again.

"Oh, for God's sake, Chester, please come back to earth." Isi sighed wearily but nonetheless affectionately to the now incredibly youthful looking Chester.

And Chester did come back to life. From one moment to the next, he was completely transformed. Now, his eyes flashing, he looked squarely at us.

"That's it," he said excitedly. "That's why they brought Kurlov the computer and information expert over from Dubna. He suspected what I know now must be the case. Where's the flipping ash tray?"

Chester was so excited now that he was scarcely able to contain his energy. I pushed an ash tray under his nose, and he managed to miss it by six inches as he knocked the big flake off of his cigar. But he was much too elated now to be concerned with ashes on his desk.

"Chester, what *are* you trying to say?" I asked as calmly as

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possible, although I too felt a thrill of excitement now, a sense of imminent and unexpected revelation.

"Just," this," Chester expostulated. "Those slant lines on the Cairo stone represent numbers, all right, but they aren't just ordinary numbers. They are Godel numbers."

Concerned as I am in mathematical logic with recursive functions, I got the point immediately. And I guess Isi did too, or at least he grasped the general and enormous significance of what Chester had just said, for he asked for no further explanation. Mouths agape, I suppose, we just sat there in silence.

And while we were sitting there, saying nothing, the little plastic cylinder rolled underneath the door. I suppose if a disinterested observer had been there to see us, he could have likened our reactions to something like those in a Three Stooges comedy short. For we all three did something of a classic double take, looking first dumbly for about five seconds at the fountain-pen-length cylinder, then looking away from it at one another, then doing the double take. I had just started out of my chair when it burst, with a dull plop, to release its potent gas into the room.

The effect was instantaneous. The three of us slumped towards the floor, all muscular control knocked out completely. Yet unconsciousness did not follow immediately. For about ten seconds I lay on the floor of Chester's office, knowing that I was blacking out, yet nonetheless capable of registering all that was happening during that time. And ten seconds was long enough to learn who had rolled the cylinder under the door and what they wanted; after about three of those seconds, the door of Chester's office opened, and three men, with handkerchiefs pressed to their noses, walked very composedly into the office, glanced about briefly until one of them saw the photograph on Chester's desk, picked it up and then left just as quietly, just as matter of factly as they had entered, softly closing the door behind them. As one of them stooped to pick up the plastic cylinder that had contained the gas, I noticed a small scar over his left eye. Then everything dissolved in front of me, and I lost consciousness.

VI

Other than leaving us with a gigantic hangover, the knockout gas had no toxic effects, and we were all back to normal by the afternoon of the following day. For the second time, we decided that accusation of the Russians

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to the authorities would gain nothing. Now they had everything that we had, and there was no getting it back, short of a return raid on their establishment. Oh, we discussed that, to be sure; but we gave it up as hopelessly unrealistic. We were amateurs in this espionage business, and they were pros. It wouldn't help matters much getting ourselves killed in some heroic but futile attempt to get back the photograph. And what if we did? Surely they would have made any number of xerox or photostatic copies of it by this time, some of them probably on their way to the sanctuary of their embassy in Washington. Besides, we had more important things to do. The first of these was to confirm or unconfirm Chester's conjecture that the inscriptions on the Cairo stone represented a Godel number.

I suppose most people have at least heard about Kurt Godel's astounding theorem, first published in 1931, concerning the incompleteness of arithmetic. The theorem tells us, to put it briefly, that any axiomatization of elementary arithmetic must be incomplete in the sense that there will always be certain sentences of arithmetic — the famous Godel sentences — which are true, but not provable from the axioms. If that doesn't make sense to you, think of it this way. It is as if

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in ordinary plane geometry you could show that it was true that the angles of a triangle, say, always added up to 180 degrees, but you could also prove that you could *not* prove that fact. Anyway, the trick that Godel used to prove his theorem consisted in reflecting sentences *about* arithmetic — sentences in a so-called metalanguage talking about the object language, arithmetic — *into* arithmetic itself. Thus Godel showed that there is a sentence *of* arithmetic to correspond to every sentence *about* arithmetic such that if the one is true, the other is too. Now take the following metalanguage sentence *about* arithmetic: "The arithmetic sentence corresponding to this sentence is unprovable." Such a sentence asserts the unprovability of an ordinary formula of elementary arithmetic, which happens to be true if and only if it is not provable.

Now the trick Godel used to mirror metalanguage statements into arithmetic itself hinged on the mechanism that has subsequently come to be called Godel numbering. It works this way. Suppose you assigned the numbers 1 through 29, say, to the 26 letters of the English alphabet, the comma, the period, and the blank space. The letter A corresponds to 1, B to 2, etc., on

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down to 26 for Z, 27 for the comma, 28 for the period and 29 for the blank space separating words in a printed text. Now take any message in English that you want to "Godelize" — *i.e.*, to which you want to assign a Godel number. What you do is write the message — supposed it is *k* units in length — as exponents, according to the pairing of letters and punctuation signs with numbers just given, on the product of the first *k* primes, written as follows: 2.3.5.7. . . . Pk, where Pk stands for the *k*th prime. Take an example, the word "cab." Since C is the third letter of the alphabet, A the first and B the second, they correspond respectively to 3, 1 and 2 in the pairing of numerals with letters of the alphabet. Now write these three numerals as exponents on the product of the three primes, and you get $2^3 3^1 5^2$, which is equal to 600. Thus the word "cab" has assigned to it the Godel number 600. And there is an absolutely unique decomposition of 600 back into a product of primes — this is a fundamental fact of mathematics. The upshot of all of this is that you can test any number in the whole infinite domain of numbers, and if it is a Godel number, it will "decompose" — *i.e.*, be factorable — into a product of successive primes with exponents which can carry coded information.

This was Chester's insight concerning the Cairo stone. He saw that if the slant lines could be construed as representing some gigantic number, and that number was a Godel number, then with a suitable program we could get the Computer Center's C.D. 3600 to factor out the primes, in which case the exponents on the primes would be the coded message. And if the Godel number was sufficient to contain an enormously complex and detailed message. Of course, we couldn't expect the exponent numbers to correspond to the English alphabet, or to any alphabet, for that matter, in any such simple way as in my example; but once we had them, we could safely assume that they were the product of an intelligence at least equal to ours, and that they *could* be decoded in some fashion into a coherent message.

Deciphering the slanted lines into a Godel number proved to be easier than I had anticipated. As I mentioned earlier, there were nine rows of lines, none of the rows containing the same number of lines, and three of them indented about half an inch. We assumed — it turned out correctly — that the stone was in its proper position with the evenly aligned (save for the indentions) side on the left. In this position,

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we noticed that the bottom row of lines, the shortest one, contained twelve numbers. This was significant. It strongly suggested a number system with the base twelve. It would not be unlikely for beings of superior intelligence to choose such a base for their number system, as in many ways it is handier than the decimal system. And recall that the Babylonians used a number system with base twelve. Reading from top to bottom, the next three rows contained 41, 37 and 43 lines. The fifth row from the bottom, which contained 39 lines, was indented. The next two rows, still reading from the bottom to the top, contained 27 and 45 lines respectively, while the eighth row, which contained 17 lines, was also indented. The ninth, or top row, contained 19 lines. After several false starts, with the computer rejecting our tape input as not a Godel number, we — actually mostly Chester and myself, Isi not being strong on this sort of thing — decided the number on the Cairo stone could be construed as just the sum of three huge numbers as follows:

43		45		
37		27		
41	+	39	+	19
12				17

It was this fantastically huge number that Chester fed into the C.D. 3600. I doubt if I shall ever forget the thrill of excitement, the shiver of impending revelation that I felt as the machine started typing out the result. For that huge number *did* factor out into a product of the primes to various powers. It *was* a Godel number, and the exponents *were* our message.

I shall not laboriously detail the final decoding of the exponents into the message they contained. You know, as well as I, that for years various projects have appeared in print for languages designed to communicate with other forms of intelligent life in our universe. Ever since the development of radio-astronomy in the late forties, the prospect of communication with other beings, perhaps of intelligence vastly superior to our own, has been a very real possibility. So, in the final decoding of the message contained on the Cairo stone, we had by no means to start from scratch; much of the fundamental research had been done already. Need I mention Dr. Hans Freudanthal's monumental *Lincos: Design of a Language for Cosmic Intercourse?* The main breakthrough consisted in discovering that the lines represented a number and that that number was a Godel number, capable of containing enormous amounts of information. This much alone as-

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sured us that the authors of the message on the Cairo stone were beings of an intelligence at least equal to our own. And once this assumption was made, we could assume that they would communi to us in that universal language that all intelligent beings must possess, the language of mathematics.

This turned out to be the case. The first series of exponents that the computer fed out were all two-digit numbers, eventually broken by a single digit serving, we discovered, as a period. What would be more logical than to assume that these numbers represented Cartesion coordinates — the first for the x-axis, the second for the y-axis? Logical, but not quite right, it turned out. The resulting graph made no sense. But eventually it occurred to us that the convention of writing the x-coordinate first and the y-coordinate second was just that, a pure and arbitrary convention. So we tried another graph, this time reversing the order of the coordinates. And this time we got something — a squiggly line with a single point underneath it. Again, I am condensing literally hundreds of hours of work into the briefest of comments. But at any rate, some time late in an August night, after endless cups of black coffee and even blacker cigars — Isi swore that his Rigolettos contained nourishment, for the spirit if not the flesh — the squiggly line and point fell into place in our minds. The line was the Mediterranean coast of Egypt — a portion of it — and the point represented, on this crude sort of map, the location of the quarry pit where the Cairo stone had been deposited, relative to the coast line. The next series of exponents were also two digit numbers, finally terminated, as before, by a single digit (the same one as before) serving as a stop, or period. This time the graph was a closed line, again with a single dot — now inside the closed figure. An island with a specific location marked on it! We ransacked the library of every atlas that it contained, poring through them for the better part of a week, until we found a remote and uninhabited little atoll in the Pacific of exactly the shape of our graph.

VII

What happened subsequently to the decoding of the Cairo stone was a fascinating lesson in the exercise of power. Isi had a conference with Dean Ortcutt on the morning following our discovery in the atlas of the atoll corresponding to the graph yielded up by the Cairo stone. Dean Ortcutt was in the Provost's of-

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fice within minutes of Isi's visit, and within seconds all three were in the office of the President of State University. From that point on the long distance wires to Washington crackled almost incessantly until the State Department, the Pentagon and finally the President of the United States were all aware of the possible staggering importance of the decoding of the slant lines. Red tape was cut as red tape can only be cut from the top-most reaches of power. Although ordinarily the detailed arrangements for archeological expeditions take months, even years to complete, we found that virtually within hours of Isi's conference with Ortcutt a massive expedition to the atoll was underway. Nominally Lt. General Foster L. McCall — chief of research and development for the Air Force — was in command of the expedition; but the *de facto* head of operations turned out actually to be our own Isidore Wolfe. Almost miraculously, Chester and I found papers on our desks authorizing sabbatical leave with full pay for the following academic year. Usually this sort of thing requires a painstaking and painful filling in and exchanging of forms lasting months. And while all of this was going on, Chester, Isi and I finished decoding the remainder of the message of the Cairo stone.

The rest of the translation of the slant lines amounted to what was basically a dictionary. It worked like this. A series of number pairs when plotted on graph paper would yield a rough outline of an object. Think of those children's puzzles where you connect points in a certain order to get an outline picture. Following would be another series of number pairs which, when plotted, would yield a short series of totally unfamiliar marks. The two together constituted a translation of the name of the object into the language of the beings of the Cairo stone. The first picture was that of a camel, the second that of a jackal. Subsequent pictures as plotted from the numbers the computer cranked out showed the camel running — followed by a series of marks including those originally correlated with those of the camel in a stationary position. So now we had a form of the verb "to run." And the same thing with the jackal sitting. And so on and on. Within a week we had a fat notebook constituting a reasonably good dictionary of the language of the authors of the Cairo stone.

A week was none too soon to finish decoding the stone, for within that time the expedition was completely organized. No expense, no effort is spared when the vital interests of a world

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power are at stake. Marine and Air Force noncoms appeared from nowhere to whisk our baggage into government cars. Waiting in the cars were high-ranking Air Force and Marine Corps officers. At the military air field where we were delivered, other officers took us in charge, fed us and wined us with amazing efficiency and speed, and got us aboard the giant Lockheed C-5A that was airlifting our expedition to the Pacific. All this without an error, and without even the appearance of haste. Isi and I found all of this exhilarating, although Chester, who was troubled with a persistent cough, appeared to be tired of it.

The flight to the atoll of the stone was without incident. We set down once to refuel at Pearl Harbor, then took off into the clear cloudless skies of the Western Pacific for the final leg of our journey. Isi, Chester and I were still working on the dictionary, clearing up minor questions of tense, gender, etc., so the time went by swiftly enough for us. Within a matter of hours we could feel the great transport losing altitude. Looking out the window over the giant wing, we could see the atoll below us, bare save for coconut palms and an airstrip with an adjoining little cluster of tents that a battallion of Sea Bees had started preparing for us the day that the expedition had been definitely decided on in Washington. Once we had touched down, we were taken with our baggage by jeep to our tents, where we settled ourselves, rested and discussed our plans for the exploration of the atoll. The next morning, after a hot breakfast with the ever resourceful Sea Bees, we met with General McCall and his staff in one of the tents that had been prepared as a sort of staff room, in which there were several tables covered with endless maps and detailed aerial pictures of the atoll, all prepared within the last week. The aerial surveys, it turned out, had disclosed a square-shaped depression, about a hundred yards on the side, almost exactly in the center of the atoll. Depressions can be explained by natural causes, but not square-shaped ones. We knew where to dig.

The bulldozers were already on site when we arrived by jeep, but Isi thought it would be a wiser strategy to start the excavation with pick and shovel to avoid the danger of destroying anything that might be fragile. This procedure was followed, but nothing turned up that way the first day. The second day he sent the bulldozers in. For two days the monster blades bit and gouged at the soft sandy earth, and at noon of

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the second day we found what we were looking for. It was the tip of a gigantic cone made of the same black obsidian-like material that we had first encountered in the Cairo stone.

We were literally frantic with excitement, of course. But it took another hard week of excavating by the whole battallion of Sea Bees before the entire cone had been laid bare, and wooden bulwarks had been erected to keep the sides of what was now a gigantic pit from caving in. But it was well worth the wait. For the cone, which was squat and the size of a large house, turned out to be hollow inside. And at its base was a small oval shaped hole, just large enough to allow a man to crawl through. Once we had scraped out the earth that had fallen into the hole, General McCall, Isi, and I entered the cone. Chester was not with us. He had been ill that morning, his cough having become more severe, and had stayed on his cot in our tent.

I said that what we found was well worth the agonizing delay. It was. For arranged on strangely convoluted tables, or benches, of the black substance, and in vast racks built into the circular walls of the cone, were thousands upon thousands of black tablets, identical in appearance to the Cairo stone. All of them were filled with the same kind of slant lines that we had first seen that night — it seemed ages ago — in Isi's laboratory. We had found the library of the beings of the Cairo stone.

VIII

Work in removing the tablets from the cone to our Lockheed transport progressed rapidly, but under the cloud now of an impending tragedy. For Chester was seriously ill. He was coughing spasmodically now, and was alternately hot and terribly chilled. As far as Isi and I were concerned, the great joy of having found the accumulated wisdom of a superior race of beings was overshadowed by what appeared to be the approaching death of our closest friend. As soon as our transport plane had got us back to the states, we chartered a small private plane and took Chester directly to Boston and the Massachusetts General Hospital. After a brief exploratory operation and a biopsy, the specialists there confirmed what the expedition's physician had suspected. Chester was suffering from lymphosarcoma, a vicious type of cancer that attacks the body's lymph system. The disease was far advanced, and the prognosis was not good. Isi and I left Chester, now under heavy sedation and barely able to recognize us, at the hospital

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and returned with leaden hearts to State University.

It was more by way of therapy than for anything else that we returned, despondent, to work of classifying and decoding the vast array of black tablets that had been deposited in a specially cleared wing of the library for us. But our despondency was lifted unexpectedly and immediately by a stroke of almost miraculous luck. For one of the first stones we started decoding turned out to be a sort of index for all the rest. We found that the Godel numbers on the various tablets were arranged according to an elaborate and systematic scheme of classification — some pertaining to mathematics, others to physics, to chemistry, to molecular biology. And still others to medicine. To medicine! Here, in our hands, was the medical knowledge of a civilization far surpassing our own. Locked in one of those tablets was the knowledge that could save Chester's life, if we could only find it.

And find it we did. We had to commandeer the Control Data 3600 full time to do it, but General McCall's three stars and a host of officers and noncoms with pistols strapped threateningly to their sides helped to turn the trick. We found the tablet pertaining to leukemia and to lymphoma-type cancers, and we decoded it within 72 hours. The crucial piece of information that it contained concerned a remarkable enzyme called L-asparaginase, an enzyme that had been used already with some success against leukemia and lymphoma victims by physicians in Dallas and Boston, but which was in desperately short supply. The difficulty was that only a minute supply of the enzyme had so far been produced by the laborious process of extraction from the bacillus *Escherichia coli*—not nearly enough for the massive and repeated doses needed to insure continued remission from the cancer. The information that we obtained from the key tablet contained detailed instructions for synthesizing this enzyme directly from laboratory chemicals. It also contained vital information on dosage and on ways to counter the side effects of L-asparaginase.

We got the drug to Boston in just the nick of time. Here General McCall, who by now had become our staunch ally, was the key factor. He provided us with a supersonic B-5 to Boston, and a siren-screeching, three-star staff car to the hospital. The drug worked; Chester's life was saved, and a momentous step in the conquest of cancer had been made.

The translation of the tablets is still going on. It will take years

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to translate all of the knowledge of a great and extinct civilization into our own language, and still more years to master it all. We still do not know the origin of the beings who left the Cairo stone in Egypt and thousands of tablets in the strange black cone-shaped library on a deserted atoll. For *this* information they did not include on any tablet. We speculate wildly on their nature — alien beings from another galaxy, or the remnant of some great civilization that once flourished on earth and, in its death throes, left indestructible evidence of its existence for future centuries to recover. But whatever their origin, they left us the knowledge to explore the universe, certainly in space and perhaps in time. We *will* know the answers to these questions, and to others of incalculable importance as well. For the means to answer them were locked centuries ago into the Godel numbers on the black tablets to which the Cairo stone led us.

—J. W. SWANSON

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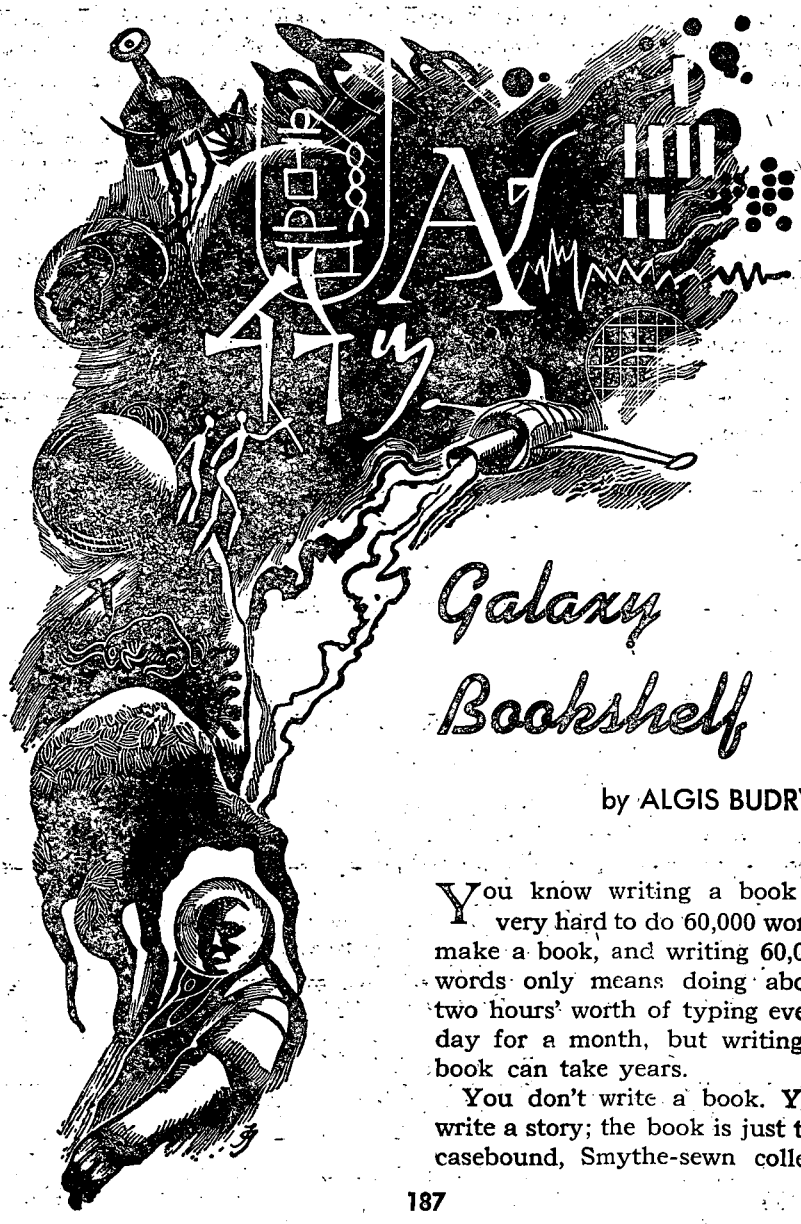

Galaxy Bookshelf

by ALGIS BUDRYS

You know writing a book is very hard to do 60,000 words make a book, and writing 60,000 words only means doing about two hours' worth of typing every day for a month, but writing a book can take years.

You don't write a book. You write a story; the book is just the casebound, Smythe-sewn collec-

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tion of what they call signatures in the book production trade, but a story is a structure of thoughts. And they come out an individual's mind. A mind . . . well, you know what a mind is. It began that day you can remember if you stand on the very tiptoes of your recollection, back into when people fussed at you and kissed you and licked and patted you into a shape they could work with. All these years, now, you've been coping in your best way with what might be called their handiwork, for want of a more descriptive term, and you've been readying yourself for whatever moment is supreme on your calendar, but suppose a passing angel said: "Explain Thyself" right now?

That — a little bit — is like writing a book, if you write books instead of 60,000 words. Eh? You follow me? For some of the many people who write, the production of a story long enough to fill a book is a reply to an examining angel, and I flatter myself I have some of them spotted.

Take a man like Roger Zelazny. Sometimes he writes better than others. In fact, sometimes — please don't send me letters about this — he writes rather poorly. It's hard to see that, because he writes with such talent that what he has to say while ignoring the story he claims to be telling is far better, and far more indicative of a good mind grasping beauty, that what you get from the people who not only write 60,000 words but the rationale to explain them, the declarations that affirm them, and the essays that enshrine them, all in one gust. Zelazny just sits there, smiling gently, dreaming his next satisfactory reply to the angel, and when the replies are more than satisfactory — which is better than Thee and Me have been doing, I'll bet you — they are zingers.

The Isle of The Dead, now. *The Isle of The Dead* (Ace) is a paperback, original about Francis Sandow, Occupation: God.

An original paperback, mind you, is not like any other literary creature. Either by first intention or because it has fallen through the hardcover buying market, it tends to be shallow; lacking somewhere. An orginal paperback comes into being most often because it's the quickest buck around — which also means the smallest buck, thence the shortest writing time. I hate to talk economic determinism, but there it is. An original paperback competes against reprint paperbacks, which have the advantage of pre-selling, of famous titles, of better-known by lines, reviewers' quotes, accumulated word-to-mouth . . . you name the com-

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mercial advantage, and the reprints have it.

Commonly, the only kinds of original paperbacks that make it at all are how-to-do-it books and similar ephemera such as westerns, murders, and, even since *Roth,* pornography.

These are not mere theories I'm handing you — or, let's put it this way; these are statements so rigorously clung to, and followed, in the publishing business, that they might as well be objective facts. Editors, agents, publishers, and, in fact, the mass audience, can all be shown to believe them, and to put — or not put — their money where it counts, as proof of their belief.

Which belief is normally justified. Original paperbacks are written for the advance money — or, in John D. MacDonald's case, the high royalty rate on the astronomical print order, plus the pleasure of it — and in order to get the advance money, you have to submit an outline that will knock an editor down. It has got to zap, snap, and promise 'em everything. And then, of course, the book has to deliver, hopefully before the advance is spent. Consequently, the original paperback — and I am very proud of each and every one of mine — typically shows signs of melodramatic plotting, and haste in the writing.

But some people are ready for the angel any time.

So. *The Isle of the Dead,* a paperback original by Roger Zelazny, either by first intention or because it fell through the market (which I at least doubt), is not like your run of the mill example.

I've brought us all this verbal way in an effort to do the impossible — to transmit the effect of experience. Parents can't do it with their children, teachers can't do it with their students, but if we each of us sit down and remember the tingle that comes over you when you do your job right, whatever the job is . . . that moment when you realize that this time it's not just okay, or the cracks won't show for a long time, or what the hell, it'll do at the price, but that, instead, this time, without regard to the price, or the acuity of the purchaser, or the specifications, this time, not because we chose to, but *because we couldn't help it,* it came out beautiful. Okay? So what if it's a toilet seat or a can of beans? There it is — and what it is is secondary; what it *has* is everything touchable proof that beauty dwells within us and presses constantly against our limits.

There. See. We did the impossible, for a moment.

Okay. Now that's what Ze-

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lazny has done. Francis Sandow, Occupation: God, fancies himself a long-live ecological positivist; a professional world-designer who is approximately the eightieth-richest man in the universe, the last survivor of the centuries-gone 1960's, commander of financial, technological and personal resources so powerful and so deft that he is a god. Neither time nor space nor the power of his rivals can stay him; love and hate are very much the same, and in the fullness of time come 'round at the same hands and lips. His every move makes and breaks unaccountable millions. And since the rocks of his worlds were drawn together by his mind, and the living things upon them are sprung from the flesh of his own body, the very birds and bears of his worlds come to love him as he passes, and the rain and rivers are his on his mountains.

All technology, of course. All explicable, or foreseeable, in the light of our own present accomplishments. No miracles, no mysteries. True, he did learn his trade at the hands of the Megapeians, and among the Megapeians a person who can create worlds, life and light is a god, with a god"s powers and attributes . . . but this, of course, is only a convenient mental set which makes the manipulations easier. And the rituals are soothing, even when clearly hallucinatory.

And when an unknown enemy begins reviving his dead enemies and his dead loves . . . often the same, as we've said . . . it's purely a matter of knocking the enemy's head clean off. Right? Climactic battle at the edge of the world while the fate of the Universe waits to be awakened . . . .

Well, I see you're ahead of me. It turns out Francis Sandow *is* a god, not just a good craftsman. Even when he creates a wart-bear, there's a difference between his wart-bear and another man's wart-bear.

The Isle of The Dead, charted on some sort of blueprint paper, would disassemble into rather plain parts, I guess. I just thought I'd preume to tell you that, just as I've presumed to try to show why you might never realize that mundane fact while reading this story.

Zelazny just sits there a lot of the time, a slight smile on his face. He seems to be dreaming.

Kate Wilhelm came upon the scene some years ago with stories like *"The Mile-Long Spaceship,"* a piece of hard science fiction whose natural home was the *ASF* of those more innocent days. She's a slim, tough, no-nonsense person, Kate is, with a strong streak of practical

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dreamer in her, and uncommon courage. You meet her, and you think of Leigh Brackett, who wrote Bogart screenplays with Raymond Chandler and William Faulkner the same time she was writing lead novelettes for *Planet Stories*. You read something like *The Clone*, which Kate wrote with Ted Thomas, and, knowing all these people, you think of Kate Wilhelm as somebody with a hell of a narrative gift, and an exact idea of what in people's minds bring them to a piece of fiction in search of storytelling.

The stories in her new Doubleday collection. *The Downstairs Room*, ($4.95), include some very tough examples. Where they falter — and they do — their problem is over-working the inability to leave a line alone, the need to round off all the corners and define *exactly* what the artist meant, so that the stark shape of what could emerge is cloaked in a sort of plastic shrink-wrap, eliminating all the jags of the orginal, and frustrating the sense of touch.

I think this may be Kate's way of showing the insecurity we all find, after all, at the root of the thing that makes us write. This is maybe why she agreed to precede each story with an explanatory note (Where are the prefaces to Steven Vincent Benet's stories? Shirley Jackson — did she affix a codicil to each testament? Where are the autobiographical intros to John Collier?). And one must simply decide that she never had a chance to read James Sallis's introduction to her work. Or maybe she did, on second thought, but like, I suppose, Doubleday's editors, shook her head and decided all that bafflegab must mean *something*. After all, anybody can write a good story — as I said, this book is full of good stories, some better than others, but all of them stories, and most of them good — but Sallis must be a genius, to be the author of "... the story has become a regenerating form of words, a total suspension of force, motive, and process ... attaining a large measure of ambiguity and resonance, and ... the elliptical, visionary qualities of the best non-realism."

Fortunately, though there appear to be occasions when she herself, God help you, Jim, forgets it. The last time Kate Wilhelm displayed any elliptical qualities was long before she got into the author business. Despite the present general effort to make us all into academicians, she continues to look more natural in overalls than she does in drag.

Suddenly the Ace Specials line is coming up with winners (as distinct from its previous high percentage of interesting fail-

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ures). *Synthajoy*, by D. G. Compton, makes me think of John Taine, Olaf Stapledon, and that bunch.

Now, the sf line of the plot is a simple one a scientist makes and markets tape-recorded emotional experiences as psychotherapeutic device. Originally, he runs the electronic equivalent of an ethical drug house, selling only by prescription. But in due course he also markets proprietary versions of the stuff to the self-indulgent, and, since one of the popular versions is a superior sexual experience, and all of them are superior experiences of one kind or another, profound social changes take place. Furthermore, he then produces an experimental tape containing not experiences but the supreme exaltations of all the possible experiences, snipped out of all the other tapes, and spliced together into one fantastic emotional nova which he is thinking of putting on the market under the name of Synthajoy. His wife kills him, or at least that's what a court says she did, thereupon throwing her in the booby hatch for . . . you guessed it . . . taped therapy.

But I invoked some powerful names up there in the preceding paragraph, and here you are, wondering in what significant detail this story could be superior to something like MacDonald's *Wine of the Dreamers* or any of the other sf stories about a world sinking below the surface of a wallow of direct brain-stimulation pleasure.

Well, the thing is that this is a story about a woman who has a problem. The woman is emotional, so it's an emotional problem. She's socially conscious, so it is a problem which implies grave consequences for the world,, in addition to herself. When she solves the problem, she in turn affects the world.

But she doesn't do it to save the world. She does it because her involvement with her husband has brought her to this point. Her involvement with her husband has made her frigid, and killed her lover — and they were indeed lovers despite her physical incapability. Finally, because she goes to a public tape-experience vending station, and at last feels what this thing is, she is in a hysterical state when she comes home and discovers her husband's mistress on the stairs, just leaving. And so she goes crazy.

Her lover had died peacefully, under the spell of the prototype Synthajoy. Her frigidity resulted from having been present at the recording session for what comes to be known as Sexitape — a play on the tradename of the ethical product, which is Sensitape.

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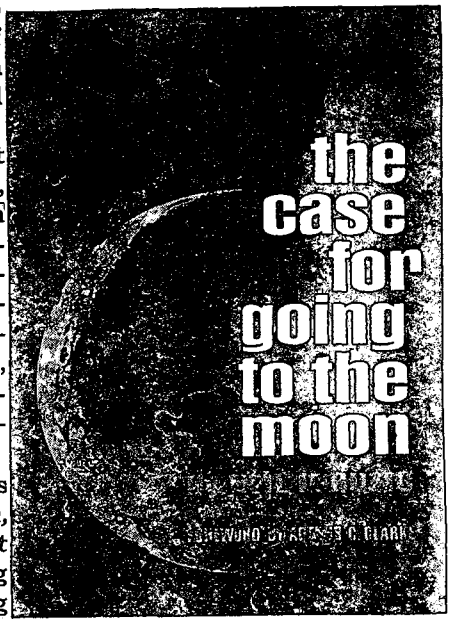
You see, what has happened to this woman happens to lots of people, but it happens to her in the filtered, recorded, amplifed and modulated form.

What I'm saying is that most sf of modern times uses people, however well-realized, to flesh out a story which, however relevant to the general human condition, has the purpose of verifying some technological proposition. But really great sf, I think, comes most often when technological assertions are used to verify a human proposition.

Synthajoy, I hasten to add, is not a *Seeds of Life* or *Odd John*, although the writing has that compelling, all-encompassing feeling that comes from telling a story in which every step people take is as important as their destinations. Compton ends on a note that would have occurred only to someone who's read a great deal of sf, or something, and decided some such plot-turn is obligatory in commercial writing. Which by the standards of commercial writing means this is, indeed, a cracking good book. More important, this is a cracking good book very nearly to the very end by the standards of cracking good books, and I hope there's going to be considerably more Compton coming into the market. A lot of us could stand the example.–ALGIS BUDRYS



A new book packed with current information on the moon-and-space program and its scientific byproducts —and an adventure into speculation . . .

This book is a "must" for anyone associated with, or interested in, the space program. Written by Neil P. Ruzic, editor and publisher of **Industrial Research** magazine, the book presents a lucid case for the exploration and exploitation of our natural satellite. It considers such areas as: research in the lunar vacuum; manufacturing operations on the moon; mining the surface of the moon; observing and probing the universe from the moon; using the moon as a base in the search for life beyond earth; and stimulating the economy through technological transfer.

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GALAXY'S STARS

Keith Laumer, whose *And Now They Wake,* starts in this issue, has been writing science fiction for a little over a decade. Captain Laumer was a career Air Force officer stationed in a remote quarter of the United Kingdom when he began; there wasn't much else to do with spare time, he had a typewriter . . . and so a career was born.

Now retired (there were not enough hours in a day for both the Air Force and the typewriter, it turned out, and the typewriter won), Laumer lives on an island in the middle of a Florida lake, and the typewriter goes faster than ever. To many readers his name will be forever linked with that of Retief, his picaresque interstellar diplomat. Nothing to wonder about if Retief's adventures in diplomacy seem to cut pretty close to the bone of the real world we live in; Laumer's *other* career was with the State Department, in Southeast Asia.

Second-place winner in the Galaxy Award voting, Larry Niven is a young Californian who had the good luck to pick an oilman named Doheny for one of his grandfathers. His award-winning story was *Slowboat Cargo* (published in book form as *A Gift from Earth,* from Ballantine Books, if you missed the magazine). While it never quite caught up with Clifford Simak's *Goblin Reservation* (originally from *Galaxy*) published in *If* in 1968, as well as distancing all but one of *Galaxy*'s 60-plus. Which is a particular pleasure to *If* readers, no doubt, because Niven was one of *If*'s "first" — authors appearing in *If* with their first professional sale anywhere — not so very long ago.

The Theory and Practice of Teleportation started out in life as Niven's Guest of Honor address to the Boskone conference a year ago this month. It seemed to us too good to let die there, so we persuaded him to put it all on paper for you . . . and here it is.

Lise Braun is a New York [redacted] housewife, and *Leviathan* is [redacted] second published story. Or first, depending on whether you call her previous piece, *The Wonders We Owe deGaulle,* a story or a "non-fact article," which is what we called it when we printed it in *Galaxy* last summer.

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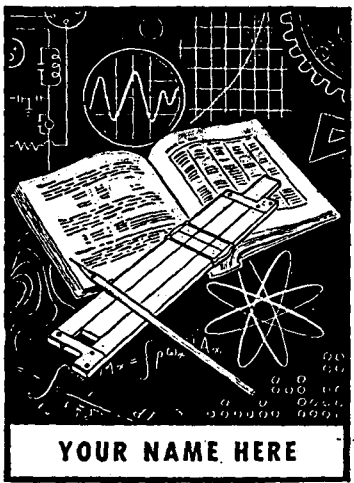

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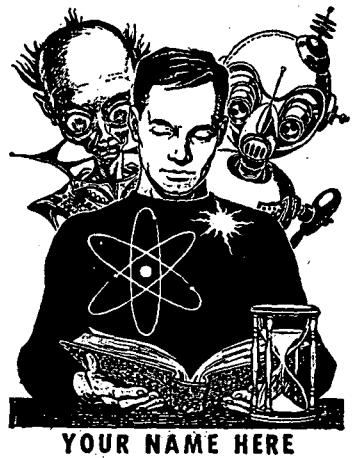

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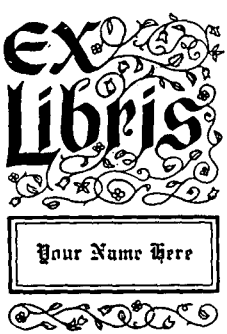

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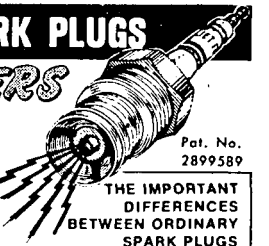

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Spark plugs are obsolete! Now there's a far better way to run your car.

With conventional spark plugs, only a fraction of the fuel that enters your cylinders is turned into power. The rest escapes through your tail-pipe as unburned vapor. That is because their spark is so narrow – only 35-thousandths of an inch wide – that it cannot possibly ignite all the fuel mixture in the cylinder. As plugs get older, their sparks get narrower and less efficient till they have to be replaced.

New Jet-Fire Fuel Igniters do a far better job of turning gasoline into power. Instead of a narrow spark, they send out a wide swath of flame that "walks" across a semi-conductor tip, fanning out in all directions and exploding far more fuel in the cylinder.

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Jet-Fire Fuel Igniters look like spark plugs merely because they have to be screwed into the spark plug socket. But what they do is far different. Here's how to prove it:

1. Run your car till it's fully warmed up. 2. Stop on a perfectly level stretch of road. 3. Put the car in Drive (1st gear with manual transmission), and see how fast the car rolls at idling speed. 4. Remove plugs and install Jet-Fire Fuel Igniters (a 10-minute job). 5. Now see how fast your car rolls at idling speed. You can expect it to go 4 TO 6 MILES PER HOUR FASTER without touching the gas pedal — dramatic proof that Jet-Fire Fuel Igniters increase engine RPMs by 100 to 150 with no increase in gas consumption. (At high speeds, RPMs increase by 300 to 350.)

So, first thing, you can reduce the gas flow by adjusting the idling screw, and **start saving money before you've even driven a mile!**

(At the same time, you can make your air-to-gas mixture leaner. Fuel Igniters require only a 15:1 ratio instead of the conventional 9:1. It's a simple adjustment that you or your mechanic can make in one minute. It provides even greater economy.)

Start driving and you'll notice even more improvement – up to 30 more horsepower of acceleration power, climbing power, and passing power. All this while burning less gas!

SWITCH TO REGULAR

The next time your gas gauge gets near the "Empty" mark, tell the attendant to fill it up with REGULAR! Chances are you'll no longer need premium which costs four to eight cents more than regular gas.

And this second saving is only the beginning. Jet-Fire Fuel Igniters provide easier cold-weather starts . . . and that means less drain on your battery, and no drain on your patience as you try to get started.

NO REPLACING OR ADJUSTING EVER

The more you drive, the better your Fuel Igniters perform. They don't become eroded, wear out or require adjusting. And carbon build-up—the natural enemy of old fashioned plugs—actually makes fuel igniters perform better. Carbon becomes an additional carrier for the igniter's big jet flame.

So there you have a third saving. One set of fuel igniters will last the life of your car!

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Jet-Fire Fuel Igniters were first developed to save airmen's lives. During World War II, there were times when more men were killed by spark plug malfunction than by enemy action. A failure-proof replacement was needed, and Fuel Igniters did the job. Both the Navy and Air Force have approved them for jet engine use.

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Some day, all cars may come equipped with Fuel Igniters like these. But why wait when you can install a set yourself now. Just mail the coupon with the make and model of your car, and we'll rush you a set with full instructions. *Just $12.80 per set of 8, $9.60 per set of 6, $6.40 per set of 4.*

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JET-FIRE FUEL IGNITERS use no sparks. Instead a fanning swath of flame walks across a semi-conductor bridge from one electrode to another, exploding far more fuel, getting far more power. There is no gap that can widen, and carbon deposits actually improve performance. They do not have to be adjusted or replaced—ever!

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